JUL 13 1916

VOL. LXXVIII. No. 2013. [All Rights Reserved.] JUNE 23, 1916. [Registered at G.P.O., as a Newspaper and Canadian Magazine rate of postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie Etrangère, 22, Rue de la Banque.
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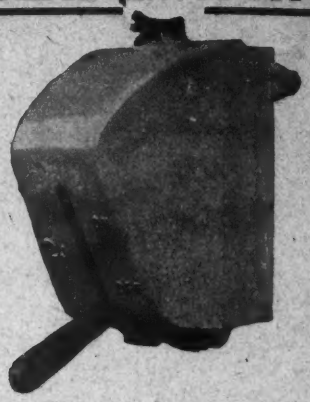

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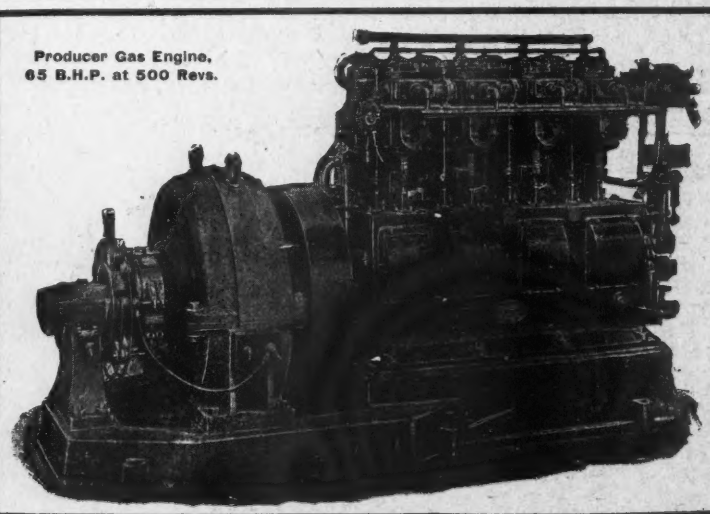

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VOL. LXXVIII. JUNE 23, 1916. No. 2,013.

ELECTRICAL REVIEW.

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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THE I.M.E.A. MEETING.

YESTERDAY, in comparatively mild weather, the twenty-first annual meeting of the Incorporated Municipal Electrical Association was opened at the Institution of Electrical Engineers. Mr. A. C. Cramb, the president, in his address touched upon a variety of interesting subjects, reviewing the work of the Council during the past year; it was inevitable that war conditions should have the effect of restricting the activities of the Council and its Sub-Committees, so that the record is rather suggestive of marking time than of steady progress, but the organisation is ready for action as soon as circumstances permit of it. We share Mr. Cramb's regret that it has not been possible, even with the kind offices of the B.E.A.M.A., to arrive at an agreement with the Electrical Contractors' Association; the terms offered to the latter are so favourable that it is difficult to understand why it should continue to form an obstacle to progress, especially at a time when the only consideration that should weigh with any British citizen is the welfare of the nation as a whole. Mr. Cramb's concluding observation on this subject has an ominous appearance.

Referring to the proposal of the Board of Trade Committee on British Trade after the War to impose upon public bodies the obligation to purchase *as far as possible* only goods produced within the British Empire, the President indicated that the Council viewed the suggestion unfavourably, as constituting an injustice to the ratepayers; judging by the report of the result of the Economic Conference at Paris, there is reason to hope that, at any rate, no more orders will go to Germany.

The three technical papers which followed were all of interest and value, touching as they did upon subjects which closely concern the future prosperity of electricity supply. The development of the turbine to so remarkable a degree of efficiency and compactness has had the effect of transferring the attention of engineers to the problems of the boiler-house, and Mr. W. W. Lackie's paper on this subject comes at a most opportune time; the more efficient utilisation of our stores of coal is one of the most urgent questions of the day. We look forward to far-reaching changes in this department of engineering in the near future, for, while Mr. Lackie discusses the subject in the light of present conditions and methods, the importance of obtaining from the coal a far greater proportion of its precious contents is rapidly gaining public appreciation. It cannot be denied that the combustion of coal in furnaces is an inherently wasteful process, and we hope that drastic reforms will be effected in this connection.

In his paper on the generation of electricity on a small scale *versus* bulk supply, Mr. Harry S. Ellis draws attention again to the question which has recently been brought so prominently before the industry in the I.E.E. discussions, and indirectly by the Board of Trade circular. Mr. Ellis holds the balance fairly between the two aspects of the question, but allows it to appear that he personally favours the independent station; as he points out, his Committee refused an offer of the North-East Coast system to supply South Shields in bulk some years ago, and "the results have been entirely satisfactory." Yet he keeps the door open for the reverse conclusion by suggesting that the linking-up of large undertakings might reduce costs, and

holds that the present chaotic state of electricity supply in this country calls for thorough investigation by a committee of members of the I.M.E.A., "with power to co-opt members of other scientific societies, such as the Institution of Electrical Engineers, the Institute of Chemistry," &c.—a remark full of significance.

Mr. W. T. Kerr's paper on the application of electricity to agricultural purposes deals with a subject which should command the attention of supply engineers in rural districts; the author points out that it has been extensively developed abroad, and proves from his own experience that it can be made a profitable enterprise. Not only the adoption of electric light and power on the farm, but also the use of electricity for intensifying agriculture, is of great promise; the latter would probably not constitute a heavy load, but it would greatly assist the demand for the former. We hope to deal with these subjects more fully in later issues.

THE FUTURE OF THE ALUMINIUM INDUSTRY.

The question of the future of the aluminium industry has just been raised in France, almost simultaneously with the annual meeting of the principal company in Switzerland that is engaged in this particular branch, although no direct connection exists between the two events. Nevertheless, it will not be without interest to hear what the Paris newspaper *L'Information* has to say on the problem as it affects the Allied nations. In the first place, it is submitted that, as in the military situation, so in the economic field should France show capability of initiative and energy, and that the country must fulfil the duty of closing to Germany the market for raw materials when France has almost a monopoly of these, as in the case of bauxite. The chief producing countries of bauxite are few. Germany only possesses the deposits in Hessen-Nassau, the quality of the mineral being declared to be more than problematical. It is true that Austria is able to furnish the former with supplies of the raw material from the deposits at Neustadt, in Styria and Carniola, and for that matter Germany has received supplies through the Dalmatian port of Almissa from the products extracted at Prechora. But the Austro-German deposits on the whole only represent a mediocre quantity for a great industry whose future is of such an encouraging character.

The allied countries, on the other hand, are particularly well favoured with deposits of raw materials. Great Britain works the advantageous bauxites at Straim, in the County of Antrim, and those at Glenravel, which afford large supplies to the works of the British Aluminium Co. The French minerals are of a clearly superior quality, and, at the same time, are abundant in comparison with the resources of their rivals in the East and their friends in the North. Thus, the minerals furnished by the Bouches du Rhone and the Var are of specially high quality, and the output is claimed to form two-thirds of the production in Europe. In addition, the Italians have discovered deposits in the Abruzzi which are not to be despised. If we now take into consideration the state of the industry in 1913, the French production of aluminium is returned at 18,000 tons, that of Great Britain (including works erected in Norway) 10,000 tons, and Italy 2,000 tons to 3,000 tons, whilst Germany turned out 7,500 tons, Austria 7,000 tons, and Switzerland 7,500 tons. The figures for the last three countries make a total of 22,000 tons, but the statistics issued by the Frankfort metal companies at the end of July, 1014, only recorded a total of 12,000 tons for these three countries combined. Leaving, however, this discrepancy on one side, and accepting the considerably higher French figures as being correct, we find the French newspaper—which states that the Neuhausen Aluminium Industry Co. is essentially a German firm whose Austrian works have been purchased by Germany—placing the Teutons in possession of 22,000 tons of aluminium per annum on the outbreak of hostilities, as compared with a combined quantity of 28,000 tons for Great Britain and France, together with 3,000 tons in the case of Italy. Such a large output on the part of Germany and Austria was only possible through its having been possible to import bauxite from France to assist in meeting their own totally inadequate resources, and in this respect the French newspaper clearly implies that the output of the Neuhausen company is controlled by Germany.

We now come to a little interesting history. The Germans, it appears, sought to monopolise the French bauxite deposits, in the same way as they endeavoured to secure possession of the iron ore resources. With this object in view, they first formed the Société de l'Aluminium Francais, which started works at Saint Louis du Rhone for the refining of alumina, and which is asserted to be merely a branch of the Neuhausen company. But the former arrived on the scene too late, as the principal deposits were already in the hands of the metallurgical companies making aluminium (Alais and Camargue, Froges, and the Métallurgique des Pyrénées), or in those of the French extracting companies (Union des Bauxites, Bauxites de France, Lecesne and Cie, &c.). Under these circumstances, the voracious appetite of the Teutons had to be content with poor nourishment. They acquired, for instance, mineral deposits at Thoronet (Var), which were so unsatisfactory that 10,000 tons had to be left at the Luc railway station, whilst the Cabasse minerals appeared to be so silicious that the motor lorries purchased for transporting them had to be put into the garages. The deposits at Vins caused the same disappointment, and although more fortunate results were obtained at Mazangues, the minerals were also greatly silicious. But these failures did not deter the Germans, who then resolved to purchase deposits which were already known and appreciated. Nine-tenths of the share capital of the Bauxites de France were secured, and the success of the scheme was celebrated in July, 1914, by the substitution of three Germans for three French directors on the Board. But the company was subsequently placed under sequestration, and although it has since been sought to replace the Teutons by Swiss representatives, the attempted deception was discovered. Now a new scheme appears to have been adopted to overcome the difficulties. This has taken the form of the announcement made by a new Norwegian company that the bauxites from the South of France would no longer be sent to Germany, but would be treated by the company in Scandinavia. Without suspecting the intentions of the company, the French newspaper pertinently asks whether the Neuhausen company is not at the back of it, apprehending a shortage of minerals for its furnaces in the event of the French Government ultimately prohibiting the export of bauxites to enemy countries after the war. The newspaper concludes by stating that it is quite obvious that the French would henceforth no longer permit the Germans to compete with them with their own (the French) products, and that the European manufacture of aluminium must be reserved for the allied countries.

It is evident from the foregoing that our French contemporary considers, as, indeed, it states, that the Neuhausen company is essentially a German firm, especially as the French Government deemed it necessary to sequestrate the company's works at Marseilles some time ago. As to the assertion that the company's Austrian works have been purchased

by the Germans, no confirmation of this statement was contained in the annual report for 1914, nor is any reference made in the report for 1915 to any transfer having taken place. It, however, naturally follows that the production of the Austrian works would be used by the Central European Powers, together with that of the Neuhausen Co.'s works in Germany, at Goldschmied-Trotha, and the new Martinswerk, near Cologne. Indeed, Col. Naville, addressing the shareholders at the meeting held at Zurich on May 6th, stated that the company had succeeded in securing extensive bauxite mines in Hungary, and the raw materials were being transported to Goldschmieden and the new Martinswerk. Under these circumstances, the chairman's fresh denial of the assertion that the company is covertly German—the statement that the majority of the capital is held in Swiss hands, and the majority of the directors and managers have been Swiss since the formation of the company—will not dispel the fact that a large portion of the company's total production from its German and Austrian works is passing into the hands of the Central Powers for use against Great Britain and her Allies. It would be of interest in this connection to learn the exact amount represented by the shares which have been returned to Switzerland since the outbreak of the war, as the Zurich correspondent of the German *Voss. Zeitung* reported at the end of April that "large amounts" had flown back. The expression of our French contemporary that the French supplies of raw material should be wholly reserved for France and her Allies in the future, as well as at present, will consequently be reciprocated by the allied nations.

The Copper Position.

THE position of the red metal continues the subject of considerable interest, despite the fact that speculation on this side has remained entirely at a standstill, in view of the prohibition in force under the Defence of the Realm Act. The sensitive state of the market may be gauged from the fact that, although dealings in warrant metal have for weeks past been virtually absent, prices have again fallen heavily, and to a much greater extent than in refined copper. The price for near delivery has now dropped to about £103, this comparing with £145, the highest touched this year, while American fine copper, which reached as high as £155 some time back, stands in the neighbourhood of £140.

That the latter shows more resistance is, of course, due to the control exercised by American producers, whose output is sold far ahead, thus encouraging them in keeping their terms at a high level as long as possible, or until they feel the necessity of competing more freely for new orders. Signs of weakness in the general outlook have, however, not been wanting, since the demand has come to a halt in all directions, even in connection with munition work. As to whether the demand in the latter respect will reassert itself again to any important extent in the near future seems very doubtful, for it is understood that war needs have been already well covered up to the end of this year. There is, therefore, a strong suspicion that no great revival of buying will be witnessed this year, while American industrial requirements, though still very heavy, have of late shown distinct evidences of falling off. Moreover, there is not much doubt that American consumers have purchased far ahead of their needs, and are now getting copper which is not actually wanted, judging from the reported resales effected lately on the part of some manufacturers. These resales, coupled with the second-hand parcels held speculatively now coming on the market, have naturally enough made themselves felt.

This factor appears to be under-rated by producers who, as a matter of fact, still profess indifference in the hope of being able to hold the market, or, at least, to protect it against any further serious fall. In the legitimate trade there is no confidence in the stability of the market, consumers generally being of opinion that it is only a matter of time when producers will be compelled to stimulate new business at considerable concessions. This view is based on the contention that the United States refinery capacity has now been very fully raised to the height of the huge mine and smelters' output. The refinery production is already estimated at about 90,000 tons a month, which should leave a very fair surplus over current requirements after making allowance for exports at the rate of 25,000 tons, which is well above the average recorded so far this year.

It may be remarked that the American exports during the first four months of this year varied between about 20,600 and 26,300 tons, and fell last month to 14,700 tons, in spite of rather easier freight conditions. Metal for early delivery is getting a little more plentiful, and producers outside the United States have, too, rather more to spare than seemed likely only a few weeks ago, and they are somewhat anxious to push business since the aspect of the market has been entirely changed. On the other hand, consumers resolutely refrain from buying beyond their early needs. Warehouse stocks on this side are still very small, but they have lately increased somewhat and the probability is that they will go on increasing.

What is an "Engine-driver"?

A REMARKABLE decision was recently given in the Federal High Court of Australia, which may have very far-reaching effects. The importance of the case is due to the system which prevails in the Commonwealth, according to which the rates of wages for the different classes of labour are fixed by the Courts. In the present instance, an appeal was lodged against a decision of the Melbourne Court of Petty Sessions, which refused to allow a claim preferred by the Federated Engine-drivers' and Firemen's Association that the driver of an electric crane should be regarded and paid as an engine-driver. The Chief Justice said that the power of the electric motor was regulated "by pressing a button," whilst that of a steam crane was controlled by operating a valve; the difference in the simplicity, or difficulty, of the operation performed by the person in charge of the crane made no difference in its character, and therefore the decision of the lower court was reversed.

This decision appears to us to show an extraordinary lack of appreciation of the fundamental difference which exists between the vocation of an engine-driver and that of the user of an electric motor; the former is a trained man, whereas anybody can operate an electric motor without previous experience, that being one of its most valuable characteristics. What the decision means to employers in Australia may be gathered from the fact that every man who drives an electric crane, hoist, tramcar, pump, or any other appliance will in future have to be designated as an engine-driver and paid according to the wages award in force—and engine-drivers are now demanding an award of no less than 12s. 8d. per day from the Federal Arbitration Court, which, from previous decisions, appears to be disposed to grant anything that Labour asks for. If technical evidence had been produced, the Court could not possibly have arrived at so absurd a decision, and we do not know why the employers concerned failed to call such evidence; perhaps they thought the truth was obvious, even to a judge. Unfortunately, the decision cannot be revised except by appeal to the Privy Council in London.

SILVANUS PHILLIPS THOMPSON: AN APPRECIATION.

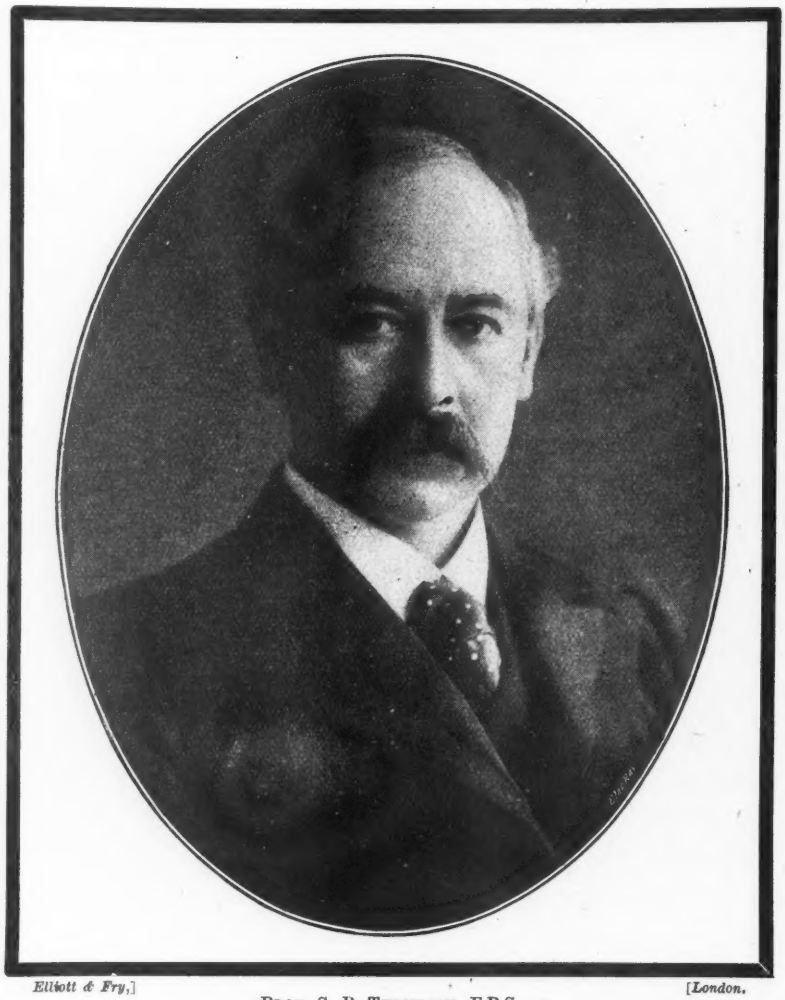
THE sudden death of Prof. Silvanus Thompson deprives the scientific and literary world of a charming personality and a man of great and diversified talents.

To many thousands of his students, and to the electrical profession, his loss will come as a shock and surprise of which they had no warning; but to his intimate friends it had become increasingly apparent during the last few months, that his health and strength were suffering severely from the long-continued strain of his work at Finsbury, and the many anxieties which the war had brought to him in an especial manner.

Silvanus Phillips Thompson was of Quaker descent and upbringing, and one of the best-known members of the Society of Friends, whose principles and influence have had such an enormous effect on the social and religious life of this country, although in mere numbers they have always been insignificant.

His public life commenced when he became Professor of Experimental Physics at University College, Bristol, in 1878, very soon after the conclusion of his student days which had given great promise of a distinguished scientific and literary career.

Indeed, it was this special combination of scientific ability and literary charm which gave him so prominent a place among his contemporaries, and he was almost as well known in the sphere of literature as in that of science.



Elliott & Fry, [*London.*

PROF. S. P. THOMPSON, F.R.S.

In the early days of electrical engineering, Thompson, then quite a young man, achieved a foremost place as a scientific expert, and his early removal to London to become Principal and Professor of Applied Physics and Electrical Engineering at the City and Guilds College, Finsbury, gave him a large field of influence, of which he made full use. Electrical science had then scarcely emerged as a distinct branch of engineering, and Thompson was one of a very few brilliant young men who grasped a unique opportunity to establish its principles on a thoroughly scientific foundation, a work shared in by Profs. Ayrton and Perry, both of whom were connected with the foundation of the Finsbury Technical College. Thompson laboured unceasingly in this work in lectures to London audiences, and by means of books and papers which had a world-wide circulation. In those days Finsbury was almost the only place in London where instruction in electrical engineering could be obtained by evening students, and the college was crowded with young men attracted by lectures of rare lucidity and fascination, while the publication of his "Elementary Lessons in Electricity and Magnetism," and subsequently a treatise on "Dynamo-Electric Machinery," established his fame both at home and abroad as a brilliant teacher, writer, and man of science, resembling in very many ways Prof. John Tyndall, whose student he was. Prof. Thompson's numerous books, papers, and published lectures are, in fact, so well known to electrical engineers, that it is hardly necessary to deal with them in detail here, and their great value has long been recognised by the electrical engineering world. It is, therefore, rather to his work in other fields that this brief memoir is concerned, since this is, perhaps, not so widely known, although it probably forms the greater portion of his life-work.

To his artistic instinct experimental work on light appealed with especial force, and it always remained a dominant attraction. His knowledge of this branch of science, in fact, was quite as encyclopædic as in the electrical field, and one could go to him, as I often did, with some perplexing question, perhaps on polarisation phenomena, or an allied topic, and find in him a mine of information. Form and colour especially appealed to him, and he revelled in the gorgeous displays which this kind of work afforded, and to which he contributed many new and original experiments and ideas. His many contributions in this field include a brilliant course of Christmas lectures, at the Royal Institution, on "Light, Visible and Invisible," afterwards published in book form; and, more recently, a translation of Huygens's famous Treatise on Light, and the theory of double refraction, a special contribution to the Optical Society on the occasion of its highly successful Congress in London a few years ago, when Thompson was President and moving spirit.

As a member of the Spectacle Makers' Co. he gave much time and thought to the diffusion of scientific knowledge among opticians, and was one of the recognised experts of this ancient City company.

In another field, that of magnetism, he was distinguished by his literary researches in connection with Gilbert's great work, "De Magnete," the writings of Petrus Peregrinus, and the history of compass cards, which latter formed the subject matter of a course of lectures delivered at University College last year. He also wrote an instructive technical work on the electromagnet, based on a special course of lectures delivered at Finsbury.

Biography had a great fascination for him, as his admirable Life of Faraday shows, but the chief work in this field is undoubtedly his Life of Lord Kelvin. His distinguished subject took a keen interest in this work, and indeed for some time they met each week for an hour or so to talk over Lord Kelvin's earlier days. Unfortunately, Kelvin died before much progress had been made, and although this was a severe blow to his biographer, he redoubled his efforts, and in a year or so completed his great task and his most considerable literary achievement. Thompson's linguistic powers also were of a high order, and electrical engineers will remember well his Italian oration in memory of Volta, while physicists will recall his services as foreign secretary of the Physical Society of London, of which body he was also president, and his lecture, delivered in German, in Berlin on the life of Faraday.

In addition to his natural gifts, Thompson was a most strenuous worker, and a holiday for him was merely freedom from routine work, and a change of scene to begin some long-cherished project, or to complete another already outlined in his pocket-book. No one was more industrious on holidays than he, and during each summer he invariably added considerably to his collection of water-colour sketches of Alpine scenery or of some favourite haunt nearer home, which later found their way to the Alpine Club, and occasionally to the Royal Academy.

His temperament, in fact, was such that he needed few relaxations, but one of these during the winter was the monthly meeting of a small coterie of distinguished literary and scientific men, the Sette of Odd Volumes, a dining club of which he was a prominent member and past president, and to the interesting proceedings of which he was a frequent contributor. Many honours and distinctions fell to him both at home and abroad, and he filled the presidential chairs of many scientific and professional societies with distinction, tact, and skill.

He was a Fellow of the Royal Society, of long standing, and took an active part in its work, especially in connection with the catalogue of scientific papers. In recent years he was elected a member of the Athenæum, in recognition of his distinguished career.

His death removes from our midst a great teacher and man of science, with rare gifts of thought and expression, which have been freely given to his day and generation.

E. G. Coker.

Following upon the cremation, which took place at Golder's Green, a special meeting was held at the Society of Friends' Meeting House in St. Martin's Lane, W.C., on Friday afternoon. The proceedings were of a most impressive character, and will be remembered for their remarkable simplicity and true sincerity. In addition to the widow and family mourners, and many members of the Society with whom the late Professor had been a fellow worshipper, as well as a profoundly respected teacher in spiritual things, there were present men of eminence in all those departments of activity—scientific, educational, literary—upon which the deceased had left the impress of his intellect and influence. These included the following:—

Sir J. J. Thomson, Sir A. B. Kempe, Sir W. Crookes, and Prof. W. B. Hardy, representing the Royal Society.
Col. E. H. Hills (Royal Institution).
Sir Alexander Pedler (British Science Guild).
Mr. C. Hawksley (Institution of Civil Engineers).
Sir H. Trueman Wood (Royal Society of Arts).
Sir Ernest Clarke (Sette of Odd Volumes).
Prof. A. Schuster (British Association).
Mr. C. P. Sparks and Mr. P. F. Rowell (Institution of Electrical Engineers).
Mr. W. J. Tennant (Junior Institution of Engineers).
Dr. R. Mullineux Walmsley (Northampton Polytechnic Institute).
Dr. Gregory Foster, Prof. Carey Foster, and Prof. E. G. Coker (University College).
Mr. E. B. Knobel (Royal Astronomical Society).
Mr. Eccles (Physical Society).
Mr. W. T. Dunn (Institution of Gas Engineers).
Mr. F. S. Spiers (Faraday Society).
Mr. A. G. Temple (Director of the Art Gallery, Corporation of London).
Prof. G. T. Morgan and Prof. Margetson, both of Finsbury Technical College.
Mr. Howgrave Graham and Mr. C. R. Darling (the late professor's assistants), also Mr. Abell, his lecture assistant.
Prof. Dalby, Dean of the C.T.C., and formerly of Finsbury.
Sir John Gavey, Sir J. A. Ewing, Sir J. Mackenzie Davidson, Sir G. Beilby, Sir W. F. Barrett, Sir John Snell, Prof. John Perry, Col. R. E. Crompton, Dr. C. V. Drysdale, Mr. Chas. Bright, Mr. C. H. Wordingham, Mr. J. E. Kingsbury, Prof. Baily, Dr. Russell, Mr. Gerald Stoney, Mr. W. R. Cooper, Mr. W. P. Thompson (of Liverpool), and many others.

At the beginning of the meeting it was intimated that the Society of Friends had no set order of service for such occasions, and it remained for those present to lead the meeting, either in devotion or by speech, as they were moved so to do. Several Friends spoke in fitting terms and tones of reverence and solemnity of the earnestness and tenacity with which Prof. Thompson had to the last clung to the same simple religious faith with which he had commenced his career of brilliance, referring also to his spirit of humility, which made no task too mean or small which might bring honour to religion or assist those who worshipped with him or who sat under his religious teaching. The temptation of intellectual pursuits had not lured him into beliefs that religion and science were irreconcilable.

CONTROL GEAR FOR DIRECT-CURRENT MOTORS.

By E. F. BUTLER.

The subject of control gear does not always receive the amount of attention it deserves, and very little information on the subject, as the result of actual operating experience, has been published. The control gear is often the weak point in installations otherwise well laid out. This may be due to a number of reasons. In some instances quotations are given for the motor only, and when the prospective purchaser finds out that he must pay for a starter in addition, he buys the cheapest form obtainable. In other cases the seller, either for fear of losing an order, or, possibly, ignorant of the various types of control gear which are available for every conceivable purpose, cuts down the price to its lowest, and supplies one of the old-fashioned forms of starter. In many instances this has failed to give satisfaction, and created a prejudice against electric driving.

In a paper given by the writer before the Junior Institution of Engineers, on February 27th, 1914, an analysis of 100 breakdowns connected with electric motors was given. It was found that 38 per cent. were on motors, and 62 per cent. on the control gear, starters alone accounting for 28 per cent. of the whole. This is confirmed by Mr. A. P. Drake (*Proceedings* of the Association of Mining Electrical Engineers, Vol. III, page 458): "The unsatisfactory design of starting switches and controllers, together with the careless way in which they are frequently handled, accounts for about 25 per cent. of the troubles that occur in motor driving."

The neglect of suitable control gear is not confined to the commercial side, which we may charitably suppose to be ignorant of these matters. This is evident from a specification, less than three months old, before the writer at this moment. It emanates from the chief engineer of an important power station. After describing the motor in great detail—bearings to be fitted with ring lubrication, armature to be slotted-core type, brushes to be of high quality carbon, &c.—it concludes: "Protected type starter with no-volt and overload release, ventilated grids and coils, also shunt regulator in series with fields for speed regulation." And this for the most important motor in the power house! Fortunately, the importance of control gear is beginning to be recognised, and some public bodies now devote a separate specification to this item.

The following remarks are not intended to be a treatise on the subject, but are written with the idea of bringing to notice some of the types which may often be used with advantage in place of the ordinary plain type, together with some notes on both good and bad features.

The familiar type of starter will be dealt with first. As is well known, the arm moves over the contacts and cuts out the resistance in so doing. The no-volt coil is energised by being placed in series with the shunt field, and holds the

arm in the full-on position against the pull of a spring. A few turns of thick wire in series with the armature form an overload coil which is intended to pull in a pivoted arm at a predetermined current, short-circuit the no-volt coil and return the arm to the off position.

This type of starter is useful for getting small and medium size motors up to speed, and when well made and carefully handled will give good service for such purposes as it is suited for. The greatest objection to it is that it depends too much upon the human element. If the arm is moved too quickly, there is a danger of passing an excessive current through the armature, and possibly melting a fuse or opening a breaker which may shut down a group of motors. On the other hand, keeping the resistance in circuit too long results in overheating or burnt-out coils,

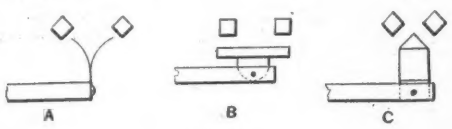


Fig. 1.

besides being wasteful of both time and energy. The writer recalls a steel works having some large rail and girder straightening presses. For some reason these were fitted with plain shunt motors, which took a large current to get under way. The starter was made up of bare iron spirals, above the starting arm. The motor was protected by a circuit-breaker nearly a quarter of a mile away, and the job was to manipulate the starter-arm at the exact moment. If it was moved too quickly the breaker opened, necessitating a walk to the switchboard, while if it was not moved quickly enough, the last spirals got red hot, and could only be kept from burning out by vigorously blowing upon them.

The trouble most commonly met with in this type of starter is the burning of the contacts, caused by moving the arm on and off the first studs. This is particularly common in the printing trade, as it is necessary to "inch" the machine, or move it round a fraction of a revolution when "making ready."

It is also very usual with machine tools when setting work, particularly with lathes having four-jaw independent chucks. When the starter arm is moved on and off the first stud, the breaking of the starting current, together with the self-induction of the shunt fields, sets up a destructive arc, which rapidly burns up the contacts, and renders the starter useless. When the motor is connected across the outers of a three-wire system, and the starter cover is earthed, as it should be, the arc often spreads to the cover, and causes a dead short-circuit, sometimes destroying the starter and burning the operator. In larger sizes trouble arises when starting up, due to the fact that as soon as the contact on the arm touches the first stud on the slate, the whole of the current passes through what is practically a line or point contact, and sticking or welding takes place. This cannot happen with a carbon contact on the arm, but a good deal of pitting and burning away is noticeable. Of course, this trouble can be got over if the attendant can be induced to get the arm full on the first step and close the double-pole switch afterwards; but this is usually asking too much. When starters of this description are met with, and it is not possible to replace them by a more suitable type, the fault can be got over by connecting the end of the resistance coil which is first cut out, to the starter arm, thus doing away with the off position altogether, and passing current through the armature as soon as the double-pole switch is closed. While this certainly gets over the trouble, it may introduce another, for if the current be interrupted and the arm flies back, the motor may run with all the resistance in when the supply is resumed. However, the author has not hitherto come across any trouble from this cause.

Whilst dealing with the ordinary type of starter, some constructional details, both good and bad, may be mentioned.

The usual internal connections are well known, and it will be noticed that as the resistance is cut out of the armature it is re-inserted in the shunt field. There is no particular objection to this, but it can be obviated in several ways, if necessary. A common method is to fit a small button contact under the last main contact, so as to short-circuit the starting resistance on the last step. Sometimes the inner end of the no-volt coil is connected to its iron core, which has the same effect. This method has the advantage that there is only one end of the coil to break off—namely, the outer end, which can be connected up again without re-winding the coil.

In good-class work it is usual to fit a brass quadrant with a small contact on the arm, so that the shunt circuit is independent of the starting resistance. It may be mentioned, in passing, that a good many no-volt coils are too weak, and the starter arm has a weak spring. If the contacts get very smooth, there is not sufficient friction to hold the arm up; if, on the other hand, the contacts get rough, the spring is not strong enough to return the arm to the off position. In fact, some makes of starters can almost be divided into two classes—those that won't stop on, and those that won't come off.

It would be an advantage if the tension of the spring were adjustable, and if a small brass set-screw and back-nut were fitted to the keeper of the no-volt coil to prevent sticking. Coming now to the overload coil, the usual source of weakness is the contacts. A very common form is shown at A, fig. 1. The trouble generally met with is the wedging of the contacts after they have pulled in. When the motor is next started, the no-volt coil is short-circuited, and the arm will not hold up. It is tied up with a piece of string, which is usually forgotten when the motor is stopped.

Next time the switch is closed, the arm still being tied up, the fuses are blown and the double-pole switch probably

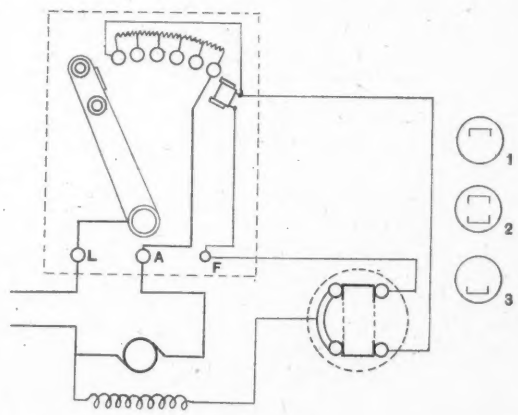


Fig. 2.

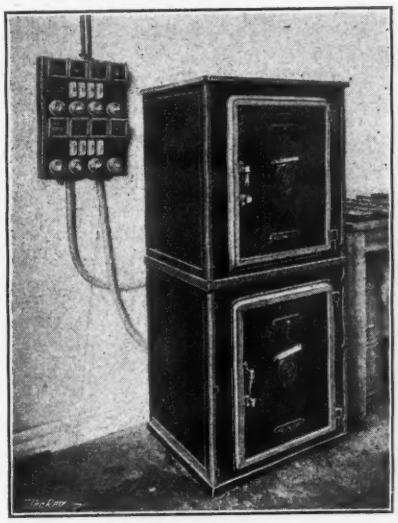
damaged. The owner remarks: "Electric driving is a great convenience; it is a pity it is so unreliable." Improved forms of contacts are shown at B and C, fig. 1, the first being a circular disk pivoted underneath, which makes contact with the lower portion of the two studs; the second consists of a short piece of round brass with a broadly-tapered end, which does not become wedged.

In order to comply with the Home Office regulations, it is sometimes necessary to arrange to shut down a motor from a distance. When a starter of the ordinary type is fitted, it is usual to run a pair of wires from the terminals of the no-volt coil to the point of control, and fix a push or switch, the closing of which short-circuits this coil, or, more correctly, more or less shunts it. The best that can be said for this arrangement is that it works—sometimes. By a simple re-arrangement of connections a much more reliable and satisfactory method is possible. Fig. 2 shows a two-way switch without an off position. When the top contact only is made, the no-volt coil is in circuit as usual. In the next position this coil is short-circuited, while in the final position, one lead to the coil is disconnected.*

Another method of connecting the no-volt coil is sometimes used when a separate regulator is used for the shunt field. In this case the coil is made independent of the

shunt field by being placed in series with a resistance directly across the mains. This obviates a common source of trouble—namely, the dropping back of the starter arm, due to the weakening of the holding-up coil.

When so connected, the overload acts by breaking the circuit of the no-volt coil, and to stop the motor from a distance the required number of switches are placed in series and normally make contact.



Baking Ovens.

The Refectory.

Arising out of these two examples, it may be noted that in dealing with problems involving the opening or interrupting of a circuit by means of magnetic switches or automatic control, it will usually be found much more satisfactory to positively open the control circuit than to shunt it more or less. With any length of wiring, and a number of dirty or oxidised contacts, it is easy to have a resistance equal to that of the coil it is intended to short-circuit.

Emergency stops may not be used for a long time, but when they are needed they are usually needed very badly, and should be reliable and positive in action.

The contacts on the slate should be renewable from the front in all excepting the smallest sizes. One make in particular should be avoided; it has segments held on by countersunk screws passing through the slate and holding the connections on the back. Countersunk screws make it easier to clean the segments, but round-headed ones enable the segments to be reversed, and both sides used. The contacts on the starter arm should also be easily renewable. For small currents a plain brass or copper strip is quite suitable, backed up by a strip of spring steel.

(*To be continued.*)

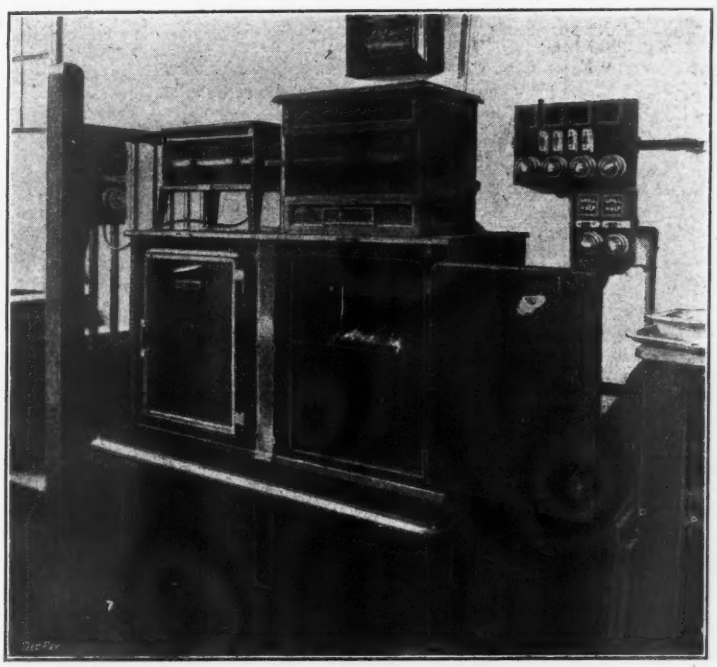
Patent Restored.—An order has been made restoring Letters Patent No. 17,026, of 1907, granted to Wm. Reavell and Reavell & Co., Ltd, for "Improvement in mechanism for converting rotary into reciprocating motion, applicable to pumps, compressors, and other machinery."

* Switch positions are indicated on right of diagram.

AN ELECTRIC RESTAURANT AT GOLDER'S GREEN, N.W.

By the courtesy of Mr. B. G. Drummond, engineer and manager of the Hendon Electric Supply Co., Ltd., we were enabled to inspect a new restaurant which has been opened at Golder's Green, and has been equipped with electric cooking apparatus. The restaurant is known as "The Refectory," and is tastefully fitted and furnished in a style in keeping with its name; and judging by the savoury odour and appearance of the dishes in course of preparation at the time of our visit, the traditions of the monastic order with regard to "living well" as an aid to leading a good life, are no less faithfully reflected in the cuisine. The enterprise is conducted by The Company of Electric Caterers, Ltd., which was formed early this year for the purpose by local residents, and the electrical equipment was installed at first on experimental lines; the establishment has now been running for about three months, and the results obtained have been so successful that the installation has been made permanent. The confidence of the promoters in their venture is indicated by the title which they have adopted, and we trust that, as a result of the experience gained in this well-known suburb, their operations will be extended to other districts.

The cooking apparatus was supplied by the Falkirk Iron Co., Ltd., its main



Roasting Ovens, Grill, and Toaster.

features including two large roasting ovens, two grilling and toasting apparatus, a hot cupboard and carving table, two pastry-baking ovens, a girdle plate, and sundry coffee and hot-water urns, milk boiler, &c., each provided with three-heat regulation. The roasting ovens, the meat grill, and the hot cupboard are loaded to 5 kw. each, the pastry ovens to 4 kw. each, and the other apparatus to 2 and 3 kw. each; they are controlled by "Diamond H" switches with indicators and pilot lights. The toaster (3 kw.) and grill (5 kw.) are fitted with convenient devices for regulating the distance of the food from the heating elements. The carving table is fitted with two vegetable trays, two carving trays, and two gravy wells, and, with the hot cupboard beneath it, has given great satisfaction to the kitchen staff.

D

All the apparatus is controlled with ironclad Henley switches and double-pole fuses, and the wiring is carried out in screwed tubing, with flexible metallic tubing as a protection to the leads entering the cooking apparatus. All the appliances are operated on single-phase circuits, but the general supply is three-phase; maximum-demand indicators are installed, for observational purposes only, and Ferranti meters, on each phase.

In the pastry kitchen, besides the pastry ovens, there is a girdle plate loaded to 3 KW., which is in great demand for the baking of Scotch scones. The pastry ovens, which are loaded with 4 KW. each, are of a new and special design to meet the requirements of the purchasers, having each four heaters, disposed horizontally at the top and bottom of the oven and under the two intermediate shelves, so that in each compartment both top and bottom heat is provided; this arrangement has been found very satisfactory. There are two hot-water urns in the lounge, loaded to 3 KW. The coffee urn above mentioned is rated at 2 KW.

We gathered from the chefs, in both the kitchen and the pastry department, that the electric cooking apparatus gave them great satisfaction, with the one exception that the upward radiation from a coke fire for grilling was preferred to the downward radiation of the electric griller; but that may be a question of taste rather than an actual defect in the system.

The complete cooking installation is more than sufficient to cater for the accommodation provided, namely, 130 to 150 persons, in addition to a large output of pastry and confectionery for sale across the counters.

It is interesting to note that none of the staff had any previous experience with electrical apparatus, but they had no difficulty in familiarising themselves with it in the space of a few days; in fact, the chefs expressed surprise that they so quickly adapted themselves to the most modern system of cooking.

The general heating of the premises is provided for by means of "Falco" and luminous radiators, and ample arrangements are made both for ventilation and cooling the air by electric fans placed in suitable positions.

The lighting is effected with half-watt lamps throughout, and in the public rooms G.E.C. alabaster semi-indirect bowl fittings are used with excellent effect.

In thanking Mr. Drummond and his assistants for affording us facilities to prepare this notice, we add our congratulations to them and to the Electric Caterers on their progressive policy, to which we wish every success. We understand that the Supply Co. will be pleased to receive visitors who wish to inspect the installation.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1916.—I.

THE annual meeting of the Association was opened yesterday at the Institution of Electrical Engineers, with the presidential address delivered by Mr. A. C. Cramb, borough electrical engineer of Croydon. The morning session was afterwards devoted to the reading and discussion of a paper on "Boiler-House Design and Operation," by Mr. W. W. Lackie, engineer and manager of the Glasgow Corporation Electricity Department. In the afternoon two papers were down for reading and discussion: "The Generation of Electricity on a Small Scale or Bulk Supply," by Mr. H. S. Ellis, borough electrical engineer, South Shields, and "The Application of Electricity to Agricultural Purposes," by Mr. W. T. Kerr, city electrical engineer, Hereford.

To-day the business meeting will take place, at which the report of the Council and that of the Electric Vehicle Committee will be presented. The following is an abstract of Mr. Cramb's presidential address:—

In attempting to look into the future of electric supply, Mr. Cramb said, one felt that in this, as in most other matters, things would never be quite the same again. When the country settled down to peaceful times people would aim at and expect greater efficiency and progress in business, and in co-operative action quicker and better results would be attained. The electrical industry needed in a greater degree the spirit of co-operation in furthering the expansion of its work for the benefit of the Empire and of its own members. When one considered the need for progress in standardisation, in publicity, in the field of domestic heating and cooking, and in the development of new lines of business, there could be little doubt that the future offered full scope for the energy of the Association.

There could be little doubt in the mind of any member of the Association of the necessity for standard conditions of contract; it was necessary, therefore, that individuals should not press their own personal prejudices to the extent of preventing the establishment of conditions acceptable by the majority. If progress was to be made, the mature opinion of the majority must be loyally accepted. Municipal engineers had in the past enjoyed the privilege of making contracts in which the contractor had little voice, and no doubt the settling of contracts in which both sides met on more equal terms might be somewhat disconcerting at first. The Council had not yet received any report from the Association of Municipal Corporations regarding the contentious clauses of the model conditions referred to them for consideration by the Association nearly two years ago. In the meantime, individual undertakings represented on the Association were accepting these conditions, and they had, he understood, been adopted by other representative bodies concerned.

The Association was indebted to the British Electrical and Allied Manufacturers' Association for their kindly offices in endeavouring to bring about a settlement of the outstanding differences between the Electrical Contractors' Association and themselves in connection with the I.M.E.A. Bill. A joint meeting took place, and it was hoped that an agreement had been reached, but the terms, as on previous occasions, were not accepted by the Electrical Contractors' Association. He wondered how long this policy of obstruction by a small section of the industry would be allowed to continue to seriously curtail the development of the business, not only of electric supply undertakings, but also of manufacturers and contractors. Even when contractors were guaranteed in the Bill that all wiring work, which would be greatly increased by the passing of the Bill, was to be placed in their hands, that supply undertakings were to be limited to prices which contractors could safely underquote, and that increased business would be brought about through hire and hire-purchase systems in which there would be no bad debts, they still hesitated to join in a course which held the promise of a considerable expansion of profitable business. Parliament had already in a number of cases granted much greater powers than those asked for in the Bill, and the present state of affairs, in which one undertaking held powers to develop its business which were denied to a neighbouring undertaking, was extremely illogical. The Association would at an opportune time again press for the Bill.

It had been the aim of the Association to effect an agreement equitable to the various interests, but it might become necessary to adopt a more active policy, to create a greater desire for settlement.

With regard to the Development Committee, the activity of which had been restricted by the war, the work of the Sub-Committee dealing with questions of electrical apparatus for cooking, heating, and other domestic requirements was urgent and important. There had been too much disjointed work in the production of cooking apparatus, and a co-operative effort by manufacturers and supply authorities was urgent. There were many matters of detail, but of great importance to success, which actual experience had demonstrated to require consideration. The production of a suitable and reliable radiant heating unit in place of the usual hot-plate was a case in which the work of the committee should yield good results. It was highly probable that valuable assistance could be rendered by the National Physical Laboratory in solving certain problems connected with electric heating and cooking.

The Publicity Sub-Committee had been instructed to prepare a complete scheme for the development of a publicity organisation in this country. Several attempts had previously been made in this direction, but in all cases had ceased after a certain period. Undoubtedly the want of funds had been the main obstacle. A first essential of success was the appointment of a thoroughly competent whole-time specialist in publicity, who should give his entire attention to the running of such an undertaking. A more liberal spirit of co-operation of the various interested parties was of equal importance. The hanging up of the I.M.E.A. Bill—which contained provision for enabling local authorities to subscribe to such an organisation—also continued to prevent progress.

The passing of the Summer-Time Act served to emphasise the courage and foresight of those undertakings which had adopted the Norwich or some other system of standing and running charges for domestic purposes before the use of metal-filament lamps became general. The advantage to the undertaking by the adoption of such a system, in maintaining financial stability against the large drop in revenue resulting from the introduction of more economical lamps and other causes, far outweighed any objections. His own experience in bringing before the householder the merits of electricity

for domestic purposes had convinced him that there was a very large potential demand if only the electrical industry were ready with a supply of suitable apparatus which could be obtained by consumers on terms comparable with those to which they had become accustomed.

Electricity committees should realise that those members of the staff who had to deal with the development of electricity for domestic purposes should take every possible opportunity of gaining actual experience with various types of apparatus in their own homes, and that all reasonable facilities should be given to this end.

The question of sufficient supplies of coal for the maintenance of electricity undertakings had been a source of anxiety during the past year to the individual members of the Association, and promised next winter to become critical. The Council had done what was possible by appointing a subcommittee to watch the question, and by supporting representations to Parliament and the Board of Trade.

The proposal of the Board of Trade to urge consumers to make a percentage reduction in lighting with a view to economy in coal was not likely to have the desired effect. The view of many supply authorities that an increase in price was the more effective way of bringing about economy was undoubtedly correct. The saving in coal owing to reduction of lighting seemed also to have been greatly over-estimated.

The work of the British Engineering Standards Committee had been approved by the Government, from whom it received financial assistance. The Association was also subscribing to the expenses, and was well represented on the various committees of the Electrical Section. He hoped that local authorities would be prepared to help forward the work by subscribing.

Experience had proved that the control of accounts by an official independent of the engineer-manager inevitably led to unsatisfactory results. Nowadays the chief official of an electric supply department must, to an increasing extent, devote his energies to the financial and commercial side of the business, whilst guiding the work of the technical staff. It would be much more satisfactory if the municipal accountant were to act as an internal auditor.

In the report of the Board of Trade Committee on British Trade after the War, it was proposed that local authorities and other public bodies should be under legal obligation to purchase as far as possible only goods produced in the British Empire. It was felt by the Council that discrimination between local authorities and private companies in this matter was unjust to the ratepayers, and that whatever restrictions were made with a view to assisting British manufacturers, they should be equally applicable to all interests.

ELECTRICITY IN SMALL HOUSEHOLDS.

By W. B. SMITH, A.M.I.E.E.

(*Abstract of paper read before the* GREENOCK ELECTRICAL SOCIETY.)

ELECTRICITY is not a luxury, and it is economical to make full use of electric energy in any dwelling-house where a supply is available at reasonable rates of charge. Much of the information here put forward is the result of three years' personal experience of electric lighting, heating, and cooking in a house in which no gas was used, and where coal was burned at intervals for the heating of the rooms, but mainly for the heating of water for washing purposes.

The only hindrance to its universal adoption in dwellings is the initial outlay required to fit up lighting installations. The curves in fig. 1 show the approximate initial cost of installations for houses of from two to eight apartments, wired in steel tubing and wood casing respectively. The figures given are for everything necessary to complete the installation with the best of materials, and allow for inexpensive fittings in the principal rooms. They do not include the provision of wall sockets.

It will be noted from the curves that the cost of wiring in screwed tubing rises in greater proportion than that of wood-casing installations as the size of house increases, due to the general practice of adopting more expensive fittings where the wiring is carried out of sight behind plaster and below floors.

To take a typical house of the semi-detached type of, say, five rooms and kitchen, the description of lamps and fittings to adopt might be as shown below. The candle-power of the lamps should be determined experimentally, taking into account the colour of walls and furnishings in the rooms. The cost of an installation of this size might be about £17 in wood casing, and about £23 in screwed tubing, while the annual bill for lighting would vary from £2 to £3.

DWELLING-HOUSE OF FIVE ROOMS AND KITCHEN.

Position.	No.	C.P.	Switches.	Fittings.
Hall	1	50	1	1 pendant (fancy shade).
Dining-room	3	30	2	Rise and fall pendant (silk flounce).
Drawing-room	4	30	2	Brackets or ceiling fixtures (fancy shades).
Kitchen	1	50	1	Rise and fall pendant (fancy shade).
Scullery	1	16	1	Pendant (opal shade).
Stairway	1	16	2 2-way	Pendant (fancy shade).
Bathroom	1	30	1	Pendant (opal shade).
3 Bedrooms	3	30	3	Pendants (fancy shades).

The actual cost of electricity for lighting in small houses naturally depends on the habits of the occupants, but from information obtained from the accounts of the Greenock electricity department it is evident that the lighting bills of domestic consumers bear some relation to the size of the dwelling. The particulars in fig. 2 have been compiled from the average lighting bills of domestic consumers in Greenock who are charged at present on a flat rate of 3d. per unit. The cost of each lamp per annum averages about 4s. In fig. 3 the variation from month to month is shown, the amounts being calculated from actual meter readings. The cost of electric lighting per month varied from 5s. 7d. in January to 7d. for the month of July.

Having demonstrated the economy of electricity for lighting dwelling-houses, station engineers are now endeavouring to introduce electric energy for other domestic uses. Many "small-current" appliances are now in daily domestic use, the most popular in small houses being the electric iron, consuming one-third to one-half of a unit per hour, the electric kettle, with quick-boiling heating element to boil two pints in less than eight minutes, and the electric vacuum cleaner. On the lighting rate of, say, 3d. per unit, the intermittent use of these "small-current" devices does not very materially increase the electricity bill. But if more frequent use is made of them the consumer should be advised to adopt the "fixed-sum" system of charging, whereby an annual charge is made for the use of the supply and a small rate of, say, ¾d. per unit, for energy consumed.

The thick line in fig. 4 gives the average standing charges for small dwellings in Greenock, while the average total electricity bill at ¾d. per unit is shown by the dotted line above.

The recent boom in electric heating is undoubtedly due to the advent of a reliable electric "fire" giving radiant as well as convected heat. In a room of dimensions 14 ft. by 12 ft. by 10 ft., the capacity of the heater required would be 2½ KW., which could be reduced to about 1 KW. after the first few hours. In Greenock there are over 400 electric radiators in use, and more than 300 of these have been sent out during the last eighteen months.

In England, where a large amount of roasting and baking is done in the household, the electric cooker is now extensively used; but in Scotland, where boiling, stewing, frying, and grilling form the greater proportion of cooking operations, the adoption of the new method has been extremely slow. The reason for this is that although the electric oven has almost reached a state of perfection, the same cannot be said of the hotplates on most electric cookers.

In the selection of an oven, top heat should be insisted on as well as bottom heat, as it enables the food to be well browned on top, and a better variation of the heat distribution in the oven is possible. Side elements are not so serviceable in this respect. The full temperature of 300 deg. or 400 deg. F. should be attained in about 20 minutes after switching on, and the oven should be lagged so that about one-half of full loading maintains this temperature. The energy used for cooking varies from 1 to 1½ units per day for each person, and the annual cost for a family of three or four

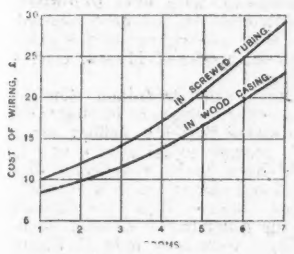


FIG. 1.

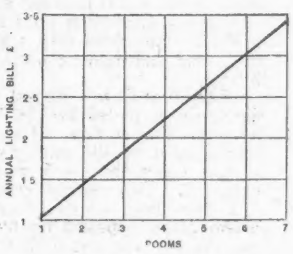


FIG. 2.

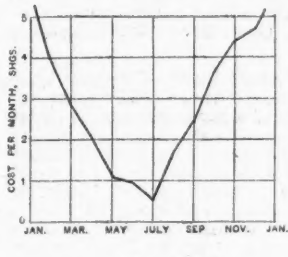


FIG. 3.

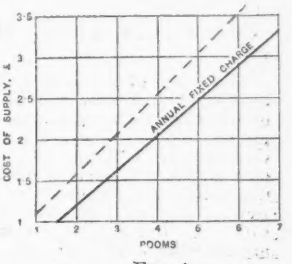


FIG. 4.

persons should not be more than £4 10s. In a small household of three persons, where the cooking is done by electricity, and where electric heaters are used for occasional heating of rooms, the lighting costs 1¾d. and the heating and cooking about 3¾d., a total cost of 5½d. per day in winter. For a day in summer the cost would obviously be much less. The average price paid for the whole supply works out at a little more than 1d. per unit.

The annual cost of cooking, heating, and lighting by electricity and coal from actual results in such a house was as follows:—

	£	s.	d.
Electric lighting at 3d. per unit, 7¾d. per week	1	13	9
Electric heating and cooking at ¾d. per unit, 1s. 5½d. per week	3	15	4½
Coal at 1s. 3½d. per cwt., 1s. 11¼d. per week	5	0	10
Total cost ... ... 4s. 0½d. per week	10	9	11½

In Dumbreck, Glasgow, eight small villas of four, five, and six apartments, have been fitted with electrical appliances for lighting, heating, cooking, &c., and the cost of electricity per annum for the year ending May, 1915, was found to vary from £20 to £30 for each house.

For a small dwelling, where no maidservant is kept, a total cost for electricity of £20, or even £30, per annum cannot be said to be excessive, considering the dirt and labour saved, and the usefulness of the whole arrangement. It might be argued that a large cooking and heating load would very materially raise the peak load of a power station without much advantage in increasing the general load factor of the station. Such, however, is not the case. In a town where in large tenement houses the tenants use electricity for lighting, heating, and cooking, although the total of the rated loads of 21 consumers in one block was 110 KW., the maximum load on the service cables supplying the block was only 13.5 KW. In the case of the Glasgow villas mentioned above, the maximum demand on the distributor supplying the houses was 17 KW., although the connected load totalled 80 KW., giving a diversity factor of about 5.

It has been shown in several towns that the domestic cooking and heating load comes on mainly at "off-peak" hours of the day, thereby tending to improve the load factor on the station, and assisting towards the cheaper cost of generation.

Experience has already shown that the middle-class domestic consumer has been the first to adopt electric irons, kettles, &c., and it would seem that it is in the small household where no servant, or at most one servant, is kept, that we may expect the pioneer work will be done in connection with domestic electric heating and cooking on a more comprehensive scale.

WAR ITEMS.

Exports to China.—The "London Gazette" of June 20th contains a further list of persons in China and Siam to whom exports may be consigned.

Export Prohibitions.—The "London Gazette" for June 16th contains a further list of persons or bodies in Greece, Portugal, Spain, Netherlands, &c., with whom or which trading is prohibited.

To be Wound-up.—Under the Trading with the Enemy Act the Board of Trade has ordered the following to be wound up:—

Standard Cable Manufacturing Co., Ltd., 18 and 19, Queenhithe, London, E.C. Agents for cable manufacturers. Controller: Mr. J. S. Feather, 35, Great Tower Street, London, E.C.

The Effect of the British "Black List."—The correspondent of "La Prensa" at Valparaiso says: "The trade war between the belligerent nations of Europe is assuming alarming characteristics here. In virtue of a decision of the British Government, a 'Black List' has been formulated consisting of Austrian and German business houses, with which no industrialist, trader, or private member of the 'Entente' Powers may have commercial dealings of any kind whatsoever. In this list there figure 14 firms domiciled in Chile, amongst the most important and best known in this market and whose business is connected with all Chilean products, but principally nitrate, as also with the Chilean import and export trade. The 'Black List' comprises the following firms: Dante & Co., with offices at Santiago, Valparaiso and Antofagasta; Folsch & Co.; Gildemeister & Co.; Kurtrts; Walter; Winkelhagen & Co.; Ernesto Hans; Leopoldo Reitze; Schultz, R., & Co.; Slomann & Co.; Stubernauch & Co.; Worwerk & Co.; Weber & Co. The effects of the British Government disposition above referred to are already being felt. The German nitrate company have closed down because British traders refuse to sell them sacks. Furthermore, the firm of Graham Rowe notified the Board of the Gatico Mining Co. (which is Chilean) that they would not supply them with coal or coke so long as Sr. Hutmann, manager of the German Bank, was a director. Sr. Hutmann resigned, but the prohibition of sale of coal still persists."—*Review of the River Plate.*

Exemption Applications.—At a sitting of the Bispham Tribunal last week, application was made by the Blackpool and Fleetwood Tramroad Co. for the exemption of 19 employés, including inspectors, cash clerks, a wireman, an engineer and engine tester, a feeder repairer, and motormen. Mr. J. Cameron (manager) said he was short of 50 men, and had put some conductors on as drivers, replacing them with 22 women. In the power house, where 23 men were formerly employed, there were now only 10 men, five being of military age and appealed for, and the rest being over age. In 1914, 73 men were employed, and 31 enlisted direct, and there were only 23 left. The exemptions asked for were the minimum. Exemptions were granted in every case—12 men 36 years old and over receiving conditional exemption, the remaining seven, who were under 36, being exempted until September 1st.

At Rochdale, an appeal by Mr. G. L. Adamson for an electric wireman, aged 22, was disallowed. It was stated that the man was on work directly affecting Government contracts. The firm had lost 50 per cent. of their men.

At Warrington, last Friday, an electrical contractor, aged 32, who was stated to be engaged on electrical work for firms on Government contracts, appealed on his own behalf. His appeal, together with others for certain of his employés, had been adjourned with a view to seeing whether badges which had been applied for were forthcoming. It now transpired that badges had not been received, and it was understood that badges would only be granted to people actually engaged in Government work on direct contracts. The applicant's manager had previously been granted exemption by the military authorities. Applicant now said he would not be disposed to leave anyone to look after his business in his absence, and the Tribunal deferred their decision.

The Portishead District Tribunal granted exemption to the manager and two other employés of an electrical undertaking, it being stated these were the only men left of an original staff of 26.

At the Oxford Local Tribunal, A. H. Pearson, ironmonger, Oxford, asked for absolute exemption for an electrician and fitter, the only mechanic left. Applicant was himself serving. Exemption granted so long as he remains in his present occupation.

At the St. Andrew's Tribunal, the Electric Supply Corporation applied for the exemption of one of their stokers, on the ground that the man was indispensable, as he had the repairs of machinery, &c., to do. Bailie Hall said: He left my employment at the gas works 14 months ago. He is only a fireman, and knows nothing about the repair of engines." Exempted till July 15th.

At the East Sussex Appeal Tribunal, an electrical kinema engineer applied for the renewal of an exemption given for one week by the Appeal Tribunal. Every effort had been made to dispose of the business, but without success, and if the engineer were compelled to serve the whole of the capital would be lost. He had a 21 years' lease. The appeal was dismissed. Leave to appeal was refused.

At Cookham (Berks), on June 14th, exemption until September 1st was granted to T. G. Hardy (32), electrician, of Pinkney's Green; and until August 14th to Harry Hill (36), in charge of the electrical plant for Sir R. M. Beachcroft at Cookham Dean.

At Rochdale, exemption until August 31st has been granted to Mr. T. Hartley, of Messrs. Fryer & Hartley, who is engaged on electrical contracts. Conditional exemption has been conceded to Mr. E. Rothwell (32), electrical engineer at the workhouse.

Two months' exemption has been granted, on the application of Mr. Woodman, borough electrical engineer at Dover, to a coal and ash trimmer. Leave to renew the appeal was given. A tramway body maker on the Corporation staff has been granted eight months' exemption, with leave to appeal.

At Calne, exemption until September 1st has been allowed to Mr. A. McKenzie (31), who is in sole charge of the electric power and lighting plant at the works of Messrs. Harris and Co.

Before the Devon Appeal Court, the Bradninch Electric Supply Co. appealed for Mr. L. Jeffery, engineer in charge of the generating station. It was stated that Mr. Jeffery came from Canada at the company's request to fill a gap, and if he was taken the work would have to be practically discontinued. Two months' conditional exemption was allowed.

At Aldershot, a final one month's exemption was allowed to two fitters appealed for by the Aldershot & District Traction Co. It was stated that there were now only 11 fitters on the staff, 50 per cent. having been lost during the past year.

The Tribunal at Wellington (Somerset) has granted exemption until September 1st to Thomas Antrobus, electrician, engaged at Nynehead Court, by Major Stobart.

At Salisbury, five men were appealed for by the electric light company. Mr. A. B. Randall (manager) said that all were essential to the satisfactory working of the undertaking. Nine employés had joined the Forces. Conditional exemption was given to a meter, battery, and testing assistant, two engine drivers and electricians, and an assistant engineer. The accountant and chief clerk were exempted until December.

At Walton-on-Thames, Mr. Robert James Rodd (35), electrical engineer, secured conditional exemption on the ground that he was the working manager of a firm engaged solely on Government work.

Before the Tribunal at Woking, Mr. W. H. Exley (38), electrical engineer, designer and draughtsman, Maybury Hill, said that he was engaged on national work, and the War Office wrote to the effect that he was doing work of the utmost importance. Conditional exemption was assented to.

At Aberystwyth, the electric light company applied for exemption for Mr. E. R. Chamberlain (22), shift engineer, in charge of a Diesel engine, a steam engine, and other plant. Mr. C. P. Perkins, the manager, stated that Mr. Chamberlain also assisted in the repair and maintenance of the machinery, and it was difficult to get men capable of looking after Diesel engines. He had only two men capable of taking charge of the engine rooms, and he could not keep the works running with less men than he had now. Conditional exemption was allowed. The same Tribunal allowed exemption until September 9th to Mr. B. W. Cheetham, electrician at the local kinema theatre.

At Reigate, on June 13th, Messrs. Tamplin & Makovski, electrical engineers, appealed for exemption for seven employés. Sir Ralph Ashton (Military representative) said that in an electrical works in which he was interested five men had been replaced by women. The appeals were adjourned at the request of Mr. Makovski.

The Reigate Rural Tribunal has refused exemption to J. Penfold (40), in charge of the electric light plant at the residence of Mr. C. F. Rowsell, of Nutfield, and E. E. Cheasley (40), electrical engineer with Mr. C. L. Bower, of Nutfield.

The East Kent Appeal Court has withdrawn exemption allowed to E. J. Farewell (36), electrician at the Hippodrome, Sheerness, and granted a final month's postponement.—Mr. V. Pomfret, of Horton Manor, Chartham, appealed to the same Court for exemption for his electrician, W. J. Pay (38). A final exemption to August 25th was granted.

At Whitstable, three months' exemption has been allowed to Mr. E. C. Spray (40), electrician; and conditional exemption to Mr. A. S. Tyler (32), engineer at the electricity works.

Absolute exemption was claimed, at Witney, by Mr. F. G. Curel, engineer and manager of the U.D.C. electricity works, for Victor Brice (18), on the ground that it was imperative for his daily duties to be executed for the proper maintenance of the public supply of current. Two assistants had already enlisted, and Mr. Curel said that it was impossible to obtain a competent man in Brice's place. Brice had another year's apprenticeship to serve, and, including himself, the staff was now only six. There was great difficulty in finding competent electricians at the present time. One month was allowed "to look round and make other arrangements."

Before the Warwickshire Appeal Court, the Military opposed exemption until November 24th granted to Mr. A. L. Smith, electrician, of Stratford-on-Avon. The Court limited the period of exemption to two months.

At Chatham, the tramway company appealed for Mr. F. W. Bone (34), station superintendent, who has sole charge of the power station, and is indispensable. It was stated that the Board of Trade insisted upon a competent and experienced man being in charge. Three months were allowed.

Conditional exemption has been allowed to Mr. W. Robbins, wireman with Mr. W. H. Smith, of Bexley (Kent), whose former staff of 28 has been reduced to four.

The Dover Tribunal has conceded conditional exemption to Mr. E. W. Wright (39), electrical engineer.

At Stoke-on-Trent, when appeals were considered from the Potteries Electric Traction Co., it was stated that the company were prepared to liberate a considerable number of conductors now, and others later. The general manager, Mr. W. Thom, said that there were 266 eligibles left; about 46 could be gradually released as women were trained at substitutes. He offered to send the men to the military in six weeks' time. This was agreed to by the Tribunal.

The Maidenhead Tribunal, on June 13th, granted exemption until October 1st to Mr. W. E. Wise (38), electrical engineer to Messrs. Wilder & Son, and until August 1st to Mr. Walter Sibley (30), electrician with Messrs. Arundell & Co.

The City of Oxford Tramways Co. appealed for absolute exemption for 29 employés. Two drivers were given one month only; the others were each exempted for three months.

Application was made to the York Tribunal in respect of three engine-room labourers, one boiler-house labourer, and one clinker wheeler, employed in the tramways department. It was stated that it had been mutually agreed that two of the claims should be refused, that two men should be exempted to August 6th, and one until September 6th.

To the Brentford Tribunal application was made for the exemption of a man engaged in the manufacture of magneto fittings for use on aeroplanes supplied to the British and French Governments. The firm had been requested to double its output, and with that object in view new machinery had been acquired. Case adjourned to enable applicant to apply for a badge.

South African Tariffs.—The Customs authorities of South Africa have recently given a decision to the effect that incandescent bulbs for pocket electric torches are to be classified under No. 114*b* of the Tariff, the general duty being at the rate of 3 per cent. *ad valorem*, with a rebate of the full duty in the case of bulbs of British manufacture.

LABOUR AND INDUSTRY.

(*Continued from page* 689.)

Many authorities are anxiously engaged with the question of how we are to employ after the war the hundreds of thousands of women-workers who have turned their hands in war-time to entirely unaccustomed pursuits. The *Engineer*, in a recent editorial, says:—"We have trained hundreds of thousands of people who had no previous knowledge of handicraft, to use these tools. What is to be done with that labour when it is no longer required for the making of munitions?" The writer replies to these questions as follows:—"A very large proportion of the labour will be glad enough to escape from the workshop and return to other duties. It is receiving now, under the impulse of necessity, wages that it is inconceivable that it should receive under peace conditions, and it is supported by zeal for its country's success in arms. Under these two influences it gives itself up to the hardship of the workshop, but when they are removed it will welcome a return to less exacting walks in life. The industrial class has broken down its boundaries, but when peace comes once again it will flow again in its old channels, widened perhaps a little, but not very greatly. The total result is that we shall have far more machines than we have workers to use."

It is, of course, impossible to forecast what the future may bring forth, but we agree with our contemporary that much of the woman labour will flow back into ordinary channels after the war—from the factory, the tramcar, the motor-omnibus, and so on. It is the stress of the times, and the desire to "do their bit" while their "boys" are away at the war, that keeps many of them working in unaccustomed ways, the strain of which they may not feel it either necessary or desirable to stand when the boys come home. In some cases they will take the place of the permanently disabled fighter and become the breadwinner, supplementing the pension; but when we read and hear prognostications of serious Labour strife after the war because the women will want to stick to their present kind of life, doing the returned men out of their positions, we are disposed to discount them as exaggerated imaginings. It is altogether too early for us to judge of the position of woman as a substitute for man in industry, however well many of them have acquitted themselves under certain abnormal conditions. Quite legitimately, the women-workers have a committee looking after their interests up and down the country, and a programme is stated to have been drawn up by which the committee hopes to ensure that a woman displaced after the war shall receive, through a Trade Union, adequate out-of-work benefit, either until she gets work or for an agreed period, and that the Government shall subsidise the Trade Unions to enable them to meet the increased cost of unemployment benefit.

At the present moment there is an urgent call being made for hundreds of thousands more women to enter the workers' ranks. As matters stand, only in this way, accompanied by the most complete dilution measures, can industrial output, which might otherwise be seriously affected by the drawing off of men for the active Forces, be maintained. Both in order to supply home needs and to assist in the upkeep of the export trade more woman labour is required. Information is being collected by a special Bureau concerning the women who are available. According to the *Daily Telegraph* there were before the war 2,180,000 women employed in industry, and by a couple of months ago 391,000 more had "enlisted."

These extra women were distributed very unevenly among the various trades. Of 49,000 who secured work between February and April, 41,000 went to the metal and chemical trades, leaving only 8,000 for all other industries, a total very much smaller than the number of men who during the same period had joined the Forces. The need for a further employment of women in these trades is therefore urgent. Some manufacturers have shown considerable enterprise, and are employing women on various new processes, the experiment often turning out quite successfully. With regard to the supply of women before the war, there were about 1¾ million who were unmarried and "unoccupied." Of these 1,000,000 were under 25, and for the most part untrained. It is pointed out that these could profitably be employed for munition work, but the needs of the other industries must not be forgotten. The textile trades, for example, employ a large number of

women, and are most important from the national standpoint on account of the export trade. These industries are now suffering severely from a shortage of trained women.

The *Engineer* article already referred to proceeds :—"The public has been shown in a most convincing way that the restriction which Labour put upon output was a very real thing, and that employers under-stated rather than exaggerated it. Very many people who will eventually leave the workshops now know by experience what output can be attained. Hence there will be a large body of public opinion against shirking and 'ca-canny,' and it is probable that under its influence the output per machine will be increased considerably over pre-war times." Taking all the different factors into account, it is concluded that we are "in possession of enormous potential energy. We have a vast number of machine tools, and we have an increased number of workpeople—not sufficient for the tools, but still increased—who are able to turn out more per individual than heretofore. How can we make use of this potential energy? That is the question to which an answer is desired, and we must confess for our own part that we see none at present, and see no probability that prevision will be of much avail." Our contemporary apparently does not consider that there will be a great demand upon British factories for the requirements of Allied countries that before the war we were not supplying. We must make within our own borders more of our own manufactured requirements, must meet the demands of the Empire, and must strain every nerve to increase the volume of our trade.

In regard to the subject of dilution, with which we have already dealt on several occasions, detailing some of the steps which have been taken to train suitable labour and the success which has attended these efforts, the extreme importance of this question is shown by a letter written by the First Lord of the Admiralty on June 8th, in which he stated that "during the period of the war nothing short of an ample scheme of dilution would meet naval requirements and secure national safety." He expressed his appreciation of the loyal way in which the skilled men on the Clyde had assisted dilution in the engineering shops, and did not doubt that those engaged on national work in the shipyards would follow their patriotic example. An important agreement on the matter has been reached between the Commission on the Dilution of Labour and the Clyde and West of Scotland District Committee of the Boilermakers' and Iron and Steel Shipbuilders' Society. We quote from the *Times* the terms of this agreement :—

1. Co-operative efforts to increase production by the adoption of all expedients which tend to increase and maintain output.

2. Interchangeability inside the boilermakers' and iron and steel shipbuilders' trade of the various classes of persons who are members of that trade, and with that purpose in view the suspension for the period of the war of all internal lines of demarcation.

3. The utilisation to the best advantage of existing skilled men, or skilled men interchanged, and the use, as far as practicable, of pneumatic, hydraulic, and electric tools.

4. The upgrading in the boilermakers' and iron and steel shipbuilders' trade of workmen to do more skilled work wherever the nature of the work and the qualifications of the men make such procedure practicable.

5. The introduction into the boilermakers' and iron and steel shipbuilders' trade of (*a*) skilled men from allied trades ; (*b*) skilled men from other trades ; (*c*) unskilled men and women in all cases where the work is of such a character, or the conditions such, as to enable the labour introduced to perform the work with reasonable efficiency.

6. The relaxation of the existing demarcation restrictions, or the admission of semi-skilled or female labour not to affect adversely the rates customarily paid for the job. In cases where men who ordinarily do the work are adversely affected thereby, the necessary readjustments shall be made, so that they can maintain their previous earnings.

7. A record of the nature of the departure from the conditions prevailing when the establishment became a controlled establishment to be kept.

8. Due notice to be given to the workmen concerned, wherever practicable, of any changes in the working conditions which it is desired to introduce as the result of the establishment becoming a controlled establishment, and opportunity for local consultation with workmen or their representatives to be given, if desired.

(*To be continued.*)

Accident.—Mr. J. McClenaghan, electrical engineer, Portatewart, was rather badly injured while motor-cycling. He collided with a horse and lorry, and the animal fell on his machine.

LEGAL.

MUNITION CASE.

THE Oldham Munitions Tribunal last week refused an application for a leaving certificate made by an employé of an electrical instrument manufacturing firm, who pleaded ill-health and declared that the fumes from a soldering-pot in the works affected him. The case had been adjourned for medical examination, and the doctor reported that the applicant was suffering from slight bronchitis and slight nasal catarrh, and that there was nothing in the place where he worked that was injurious to his health. On hearing the decision of the Tribunal, applicant said his parents insisted on his leaving the place, and he took it he could do so if he "played" for six weeks. Mr. J. Hodgson (President) said that it was not for the Court to advise applicant what to do. The manager of the firm asked that the case should come under Sec. 22 of the Act in regard to the doctor's costs in examining the works, and he contended that the applicant ought to pay the doctor's costs because the proceedings, he alleged, were vexatious and frivolous. The allegations as to the working conditions had been proved unfounded. Mr. Hodgson said he did not think the proceedings were vexatious or frivolous ; there was no application by the complainant for the doctor to examine the works, and he (Mr. Hodgson) did not think Sec. 22 applied here.

INJUNCTION AGAINST AN IRISH ELECTRICAL CO.

IN the Irish Chancery Division, before the Master of the Rolls, a consent was received and made a rule of Court in an action by Mary E Ewing against the Irish Towns Electric Light and Power Co., Ltd., defendants agreeing to an injunction restraining them and their servants and agents and workmen from using or working on their premises at Newcastle, Co. Down, any gas engine or machinery in such a manner as, by reason of vibration or otherwise, to injure plaintiff's dwelling-house and premises at Slieve Dhu, Newcastle, or from interfering with or annoying her.

BUSINESS NOTES.

Board of Trade Inquiry.—The Board of Trade Commercial Intelligence Branch in London has the name and address of a Calcutta firm which desires to communicate with British manufacturers of electrical fittings, such as cut-glass chandeliers, &c.

Monometer Furnaces.—We have received a lengthy list of orders recently received by the MONOMETER MANUFACTURING CO., LTD., of Aston, Birmingham, for their specialities. These include contracts for a number of well-known electrical manufacturing firms and many industrial works of other classes in this country. Monometer aluminium melting furnaces are being exported to Italy and other types by the same firm to Australia and the United States. The Monometer tilting furnace is now constructed for coke firing as well as for oil and gas.

Electricity in Collieries.—Mr. A. F. Pease, presiding at the annual meeting of Messrs. Pease & Partners, Ltd., at Darlington last week, said that the firm had been extremely fortunate in getting nearly all their electrical schemes completed before the war, and it had meant a large saving in labour in their collieries and mines in these difficult times, and left them with a larger amount of coal at the collieries to dispose of.

Patent Applications.—As announced in our advertisement pages, Mr. C. B. Kersting has applied for permission to amend Patent No. 22,549, of 1914, for "Improvements in intercommunication telephone systems."

Messrs. A. G. Hopper, J. E. Hopper Greenwood, and K. Anderson have applied for restoration of Letters Patent No. 25,363, of 1907, granted to A. Greenwood and K. Anderson.

British Trade with Italy.—The British Chamber of Commerce for Italy (Inc.), whose registered London office is at Oxford Court, Cannon Street, E.C., has issued particulars of membership in the Chamber. An official notice from Italy states that the new headquarters of the Chamber at 7, Via Carlo Felice, Genoa, with exhibition show-cases, are now ready. They are centrally situated near the principal business buildings, and in the showrooms will be displayed a sample exhibition of British goods suitable for import into Italy. Communications respecting terms for space, &c., should be addressed to Mr. E. B. Weatherhead, the secretary-general, at the above address at Genoa. The Chamber has branches in Milan, Tuscany, Rome and Naples.

Catalogues and Lists.—ALLIES ELECTRIC LAMP REPAIRING CO., LTD., Montgomery Street, Hammersmith, London. —Folder giving particulars and prices of "old lamps made into new" by their regenerating process.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—A showcard measuring 17 in. by 22 in., attractively designed and executed in 11 colours, has been issued for the purpose of assisting the popularisation of "Magnet" electric fires. Afternoon tea is the subject of the picture.

Book Notices.—"Discovery; or, the Spirit and Service of Science." By R. A. Gregory. London: Macmillan & Co. Price 5s. net.

"*Proceedings* of the Physical Society of London." Vol. XXVIII. Part IV. June 15th, 1916. London: The *Electrician* P. and P. Co., Ltd. Price 4s. net.

Manchester Steam Users' Association.—The annual report of the Committee of Management shows that in 1915 there were 2,089 members, and 10,793 boilers under inspection, and the revenue was £22,642—record figures. The year was the busiest the Association had ever experienced, 22,297 examinations being made.

Meter Approved.—The Board of Trade has approved of the Westinghouse single-phase watt-hour meter, type K, deposited in March, 1915, by the British Westinghouse Electric and Manufacturing Co., Ltd.

Dissolutions and Liquidations.—Marine Smokeless Mechanical Stoker Co., Ltd.—This company is winding up voluntarily with Mr. T. W. Gilbert, Blomfield House, London Wall, E.C., as liquidator.

Ebury Electrical Engineering Co. and Ebury Garage, automobile and electrical engineers and lighting equipment experts, 80, Ebury Mews, Victoria, S.W.—Messrs. R. Ormes, H. K. Gossip and H. Jones, have dissolved partnership, Mr. Gossip retiring. Debts, &c., will be attended to by the other gentlemen named, who will continue the business.

Stellar Signs, Ltd.—A meeting is called for July 18th, at 11, Pancras Lane, E.C., to hear an account of the winding up from the liquidators, Messrs. A. C. Hutchins and V. G. Morris.

Colston Electrical Works, Ltd., Bristol.—First meetings of creditors and contributories, June 28th, at 26, Baldwin Street, Bristol.

Bankruptcy Proceedings.—J. Boult and J. H. Bolt, electricians, Liverpool; also John Boult, separate estate.—July 5th is the last day for the receipt of proofs for dividend. Trustee: Mr. P. S. Booth, 2, Bixteth Street, Liverpool.

James Brockie, mechanical engineer, Forest Hill.—July 3rd is the last day for receipt of proofs for dividend, by the Hon. W. J. H. Boyle, 132, York Road, Westminster Bridge Road, S.E., the trustee.

Trade Announcements.—Messrs. Donnison, Sillem and Co. have decided to close the business of general and electrical engineers and contractors which they have been carrying on at 116, Great Portland Street, W., for the past 20 years. Mr. Donnison has entered into a working arrangement with Messrs. Girdlestone & Co., electrical engineers, of 23, Davies Street, Berkeley Square, W., and he will continue to give his personal attention to orders. Mr. Sillem is retiring from the business.

The style of the firm of Eckstein, Heap & Co., Ltd., Manchester, has been altered to *Erskine, Heap & Co., Ltd.*

LIGHTING AND POWER NOTES.

Aberdeen.—Plant Extension.—The Corporation Electricity Committee has considered the matter of the extension of the generating plant, together with a supplementary report from Mr. Bell, the engineer, and has instructed Mr. Bell to obtain tenders.

Aylesbury. — Price Increase. — The U.D.C. has arranged to supply electricity to the Dominion Dairy Co. at 1½d. per unit up to 20,000 per quarter, and 1⅜d. per unit beyond. The existing rates of charging for lighting and power have been increased by 10 per cent.

Ballymoney.—Public Lighting.—The Council has considered the question of lighting the town by electricity, and has instructed the clerk to inquire of the L.G.B. with regard to the powers possessed by the Council for raising money by loan.

Boothstown.—Electric power, generated on the spot, is now being utilised to drive the machinery at Lord Ellesmere's Mosley Common Collieries, Boothstown, near Manchester. These collieries are amongst the largest and deepest in England, and employ 1,800 men and youths.

Bournemouth.—The Electricity Supply Co., in view of the fact that the Council has not been able, owing to lighting restrictions, to take the minimum quantity of energy specified in the contract, offered to make an allowance of ½d. per unit upon the balance of the minimum consumption; the Council has accepted the proposal.

Burton-on-Trent.—Year's Working.—The report of the year's working of the electricity department shows a total ordinary income of £20,310, and works expenditure £9,542. The profit-sharing bonus amounted to £228, leaving a gross profit of £10,540. After meeting loan and other charges, the surplus remaining was £1,938, as compared with £2,566 last year. The surplus has been allocated as follows:—£1,308 to meet capital expenditure on transformers, mains, and services, in lieu of borrowing; £520 for depreciation of Consols, and the balance of £110 was carried to the renewals fund. The total capital expended, including £2,616 during the year, was £127,389, of which £14,943 had been provided out of revenue. The total number of units sold was 3,499,388, as compared with 2,914,828 in 1915, an increase of 584,510. The principal increase was in sales for power and heating. The H.P. of motors connected increased by 357 during the year, the total being 3,360 H.P. The total costs decreased from 0·686d. per unit to 0·658d; the installation of the new turbo-generator was mainly responsible for the reduction. The maximum load of 1,751 KW. was recorded on December 9th, 1915, representing an increase of 431 KW. on last year.—*Burton Daily Mail.*

Chester.—Year's Working.—The report of the City electrical engineer, Mr. S. E. Britton, for the past year shows that the electricity department made a gross profit of £12,370 and a net profit of £2,956 as compared with £12,483 and £3,194 respectively in 1915. These figures embody the results of the steam and the hydro works.

During the 12 months 1,567,300 units were generated by water-power, of which 16,062 were used for pumping sewage, 1,600 were used for lighting the works, 42,310 for excitation and feeder booster, 128,122 in the distribution cables, and 1,379,206 were sold to consumers. The cost of operating these works and producing the above quantity of electrical energy was as follows:—

Oil and stores	£28	
Wages	242	
Repairs and maintenance	64	
Rent	100	
Rates and taxes and insurance ...	138	
Total works charges	£572	*i.e.*, ·0995d. per unit sold.

The capital charges were:—

Interest on loans	£490	
Sinking fund charges	524	
Total capital charges	£1,014	*i.e.*, ·1765d. per unit sold.

The total cost was ·276d. per unit sold—a remarkable result, which should give great satisfaction to Mr. Britton and his Committee.

The total output was 3,467,323 units, of which private consumers took 1,076,523 and bulk supply took 917,117; the tramways purchased 391,329, and public lighting (946 inc. lamps) consumed 283,089, making a total of 2,668,058 units sold, compared with 2,535,600 in the previous year. Including the whole of the plant, the average works costs came to 0·583d. per unit sold, and the total costs to 0·877d. Coal alone cost 0·285d. per unit sold, and as only half the output was generated by steam, it would seem that the cost of coal for the steam units was about twice as much as the total cost, including capital charges, of the water units.

Dover.—Year's Working.—The report of the Corporation electricity department for the year ended March 31st last shows that 1,572,604 units were sold, an increase of 53,947 on the previous year. The total expenditure on capital account to date was £192,184, including £3,814 on mains extensions for Government use and £277 on new works. The total receipts for the year were £23,586, £21,560 being for electricity supplied. Working costs amounted to £13,572, leaving a gross profit of £10,013. Interest on capital amounted to £7,593, and contributions to sinking fund to £4,174, making a total of £11,767. There was a net loss on the year's working of £1,754, which has been taken from the surplus of £3,080 brought forward from last year.—*Dover Express.*

Farnworth.—Electrical plant is to be put down in place of gas power in the Piggott Street spinning mill, Farnworth, belonging to Messrs. Hollas & Farnworth.

Gillingham (Kent).—Tar Oil.—Owing to the high price of fuel oil (£8 16s. 3d. per ton), the T.C. has referred to a Committee the question of using tar oil at the electricity works, the cost being 80s. per ton, and the efficiency 10 per cent. less than with ordinary fuel oil. About 500 tons per year are used, and with the use of tar oil there would be a yearly saving of £2,200, while the cost of the necessary apparatus for the two engines would be £515.

Great Harwood.—The B. of T. has granted the U.D.C. an extension of the Electric Lighting Order to August 7th, 1917.

Greenock.—Loan Sanction.—The Secretary for Scotland has agreed to grant borrowing powers in connection with the Corporation's electricity extension scheme for the full sum of £45,000, instead of £35,000 sanctioned previously. Repayment is to be spread over 25 years. Sanction is given subject to the condition that the whole surplus revenue of the undertaking, after meeting working expenses, depreciation, and debt charges, is transferred annually to the reserve fund, until that fund has reached its maximum. Immediate steps will be taken to proceed with the work involved in the scheme.

Heywood.—Year's Working.—The working of the electricity department for the year ended March 31st, 1916, has resulted in a loss of £1,052, including £112 for obsolete plant, disallowed by the L.G.B.

The Roeacre Dyeing and Felting Co., Ltd., has asked for a supply of electricity, and the electrical engineer is to report to the Committee on the matter.

Kilmarnock.—In view of questions that have been raised from time to time regarding the administration of the electricity department, the T.C. has decided to ask Sir Alex. Kennedy to make a general survey and report on the position of the electricity works, and to retain him as consulting electrical engineer for the burgh.

Kingswinford.—Public Lighting.—The R.D.C. has arranged with the Midland Electric Corporation for the public lighting account from January 1st to June 10th, amounting to £550, to be reduced by £150, on account of restricted lighting, on condition that the contract is renewed for three years at the old rate, only lamps actually lighted during the war period to be paid for.

London.—Price Increase.—The Charing Cross, West End and City Electricity Supply Co., Ltd., announces that, owing to the refusal of the B. of T. to allow the company to increase the charges for electricity by 10 per cent., it has decided to fall back on the powers conferred upon it by the Act of Parliament and the City of London Electric Lighting Order, 1899. The new charges for lighting, which are to come into force at the end of June, are:—Each quarter 5d. per unit for the first three units consumed per 30 watts of connected demand; each quarter 4d. per unit for the next 8 units consumed per 30 watts of connected demand. All units in excess will be charged for at 2d. per unit.—*City Press.*

Middlesbro'.—Year's Working.—The report of the electrical engineer, Mr. R. H. Scotson, for the past year shows revenue £25,087, as compared with £25,365 the previous year, and expenditure £14,419 (·727d. per unit) as against £14,372 (·985d. per unit). The gross profit for the year was £10,668, as compared with £10,994, and the net profit £3,325, as against £3,978. The number of consumers was 2,147, as compared with 2,001, and the average price per unit sold was 1·47d., as against 1·74d. the previous year. Certain alterations he suggested a year ago had been carried out with results more satisfactory than was expected. They had sold over 550,000 more units than in the previous year, yet the combined cost was only £14 more, whereas if this extra current had been generated under the old arrangement it would have cost at least £1,150. They had saved on generation alone £1,136, in addition to the wages of six men, whom it had been possible to dispense with.

The revenue had been adversely affected amongst other things by reduction in private lighting of £2,442, public lighting of £135, and market lighting of £13. The total reduction of £3,423 was entirely due to the war, but had been met by increased revenue from power of £2,241, and a saving on wages of £529, leaving a reduction in the net profit of £653.

Newcastle-under-Lyme.—The T.C. has decided that in future a minimum charge of 5s. per quarter shall be made for electricity services.

Newfoundland.—The Imperial Trade Correspondent at St. Johns (Mr. H. W. Le Mesurier) reports the passing of an Act to incorporate the Union Electric Light and Power Co., and for other purposes. The capital of this company will be about £20,550, and it is authorised to install an electric light and power system and operate electric tramways in the towns of Trinity, Catalina, Bonavista, &c. The company is also granted the exclusive right to use the waters of several lakes and streams.—*Board of Trade Journal.*

Oxford.—Price Increase.—The Oxford Electric Co., Ltd., announces that after the reading of the meters for the June quarter there will be an increase of 20 per cent. on the present charges for electricity.

Paisley.—Switchboard Fire.—Owing to a breakdown at the electricity station, Blackhall, recently, the supply was for a time seriously impaired. It was found that the high-pressure switchboard had caught fire, and six hours elapsed before repairs could be executed.

Shropshire.—The *London Gazette* for June 16th contains a notice of the application of the Shropshire, Worcestershire and Staffordshire Electric Power Co. for Parliamentary sanction to amending their borrowing and other powers.

Swansea.—Mains are to be extended to Prince of Wales Road, at a cost of £250. The B. of T.'s letter *re* the interconnection of supply undertakings, in order to effect saving in coal, has been referred to the chairman and vice-chairman of the Electricity Committee, together with the engineer, with a view to the proposals being extended, in a similar manner to the Corporation's arrangement with the tramway company, to other large independent consumers of electricity.

Slaithwaite.—The B. of T. has extended the U.D.C.'s electric lighting order for one year.

Sweden.—A new company has lately been formed at Alfdalen, with a capital of £50,000, and the title Alfdalens Elektrizitetswerk Aktiebolag, to acquire the rights to certain waterfalls in the district, and to establish electricity generating plants to utilise the same.

Tasmania.—New Undertaking.—The inauguration of the Wynyard (Tas.) municipal electric light undertaking took place recently; the generating plant at present installed consists of an 84-H.P. Hornsby suction gas engine driving a 45-KW. D.C. 460-volt three-wire dynamo with static balancer. The storage battery of the Chloride type consists of 256 cells of 460 ampere-hours' capacity. There are 50 street lights, 42 of 100 C.P. and 8 of 500 C.P. The scheme has started under very satisfactory conditions as to load; 150 houses were wired and connected, with 40 waiting to be completed, making 190 connected to the plant in the first six weeks of operation. The motor load is also large, and is steadily increasing. The Council's engineer is Mr. A. L. Kerr, to whom is largely due the successful loading of the plant.—*Commonwealth Engineer.*

Tottington (Lancs.).—The D.C. has granted an application made by the Lancs. E.P. Co., to cross Harwood and Bradshaw Roads with their overhead mains.

Walkden.—Amongst the latest cotton mills (weaving and doubling) in Walkden to adopt additional electrical installations are Mr. W. A. Rothwell's Primrose Mill and Messrs. Faulkner's Granville Mill. Further developments in this direction are expected at Messrs. Burgess, Ledward & Co.'s Wardley Mills.

Walsall.—Year's Working.—The total expenditure on revenue account of the electricity undertaking during the twelve months ended March 31st last was £4,496 more than in the preceding year, the respective figures being £18,789 and £14,293. The increased cost of generation contributed largely to this increase, the total for the year under review being £11,699 as against £7,920, or an increase of £3,778. £22,026 was received from the sale of energy for lighting, power and bulk supply, £6,726 from sale of energy for tramways, and £553 from public lighting, making, with minor items, total receipts £29,573, or 1·84d. per unit sold, compared with £25,879 in 1915. The balance of £10,784 is carried to net revenue account. From this has to be deducted interest on loans and stock (£4,936) and contributions to sinking funds (£6,747), leaving a deficit on the year's working of £899. The Town Council is recommended to defray this loss out of the reserve fund.

The rotary converter on order for the Darwall Street sub-station is being taken over by the Minister of Munitions, on condition that it will be replaced without any cost to the Corporation. The Electricity Committee proposes to extend the mains to the works of Messrs. Craddock & Sons, at Wisemore.

Walton.—It was reported at last week's meeting of the U.D.C. that the B. of T. had considered the application of the Urban Electric Supply Co. to be allowed to discontinue the maximum demand, with the result that the Board's representative intimated that he would recommend the Board not to accede to the application for a minimum charge asked for by the company—viz., 11s. 7d. per quarter—and that he would recommend that the maximum charge should be increased to 7d per unit.

Wolverhampton.—Plant Extensions.—The Electricity Committee of the Corporation has decided to make application to the L.G.B. for permission to borrow £34,240, being £53 900 for the extensions contained in the electrical engineer's report of February 21st, 1916, less £19,660 for which borrowing powers had been already asked. The Finance Committee has been authorised to borrow the money, and, if necessary, to raise Wolverhampton Corporation stock for the purpose.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—Tramway Purchase.—The T.C. has adopted a recommendation of the Tramways Committee that a Bill be promoted in Parliament to obtain powers to enable the Corporation to acquire the tramways of the Oldham, Ashton, and Hyde Electric Tramways, Ltd, within the areas of Waterlow and Bardsley.

Australia.—The report of the Deputy Chief Commissioner on the working of the N.S.W. Government tramways for the quarter ended March 31st, 1916, shows revenue £514,661, an increase of £10,178; expenditure, £378,560, an increase of £5,773; and number of passengers carried, 75,537,540, an increase of 2,141,640.

During April two electrical tramway services were opened in Melbourne and its suburbs. The first is that from Princes Bridge, Melbourne, to Hawthorn and Burwood, the total cost of which, when completed, will be approximately £220,000; electricity is purchased in bulk from the Melbourne Electric Supply Co. The second opened was the Coburg section, about two miles of the Melbourne, Brunswick and Coburg tramways.—*Commonwealth Engineer.*

Colchester.—Year's Working.—The annual report of the Corporation tramways for the year ended March 31st last shows total revenue £15,741, an increase of £1,919 over the previous year. The gross profit on the year's working is £5,043; after payment of interest on capital £1,853, allowances to men with the Forces £187, and sinking fund charges £2,590, there is a net profit of £440, compared with a loss last year of £402. The total amount appropriated from revenue for repayment of loans since the commencement of working is now £24,619. The total revenue per car-mile was 11·41d. as compared with 9·96d. in 1915; and total working expenses per car-mile were 7·73d. as against 6 90d.

Croydon.—Tramway Strike.—The South Metropolitan Tramways Co., which has had a dispute with its employés, has concluded an agreement which is to be retrospective to the beginning of May, and to continue till 1919, the terms and conditions being similar to those obtaining under the L.C.C. The strike of the Croydon tramway employés still continues.

Glasgow.—WAGES DEMAND.—The motormen and conductors (male and female) in the employment of the T.C., to the number of 3,100, have applied for an increase of 6s. per week on their present scale of wages, on the ground of increased cost of living. Since the war started, all motormen and conductors have received an increase of 2s. weekly, and in addition a bonus of 2s. was paid to men whose wages were under 30s. weekly. The general manager is to report on the application, and it has been pointed out that the increase, if granted, would represent a weekly payment of £930, or an annual additional expenditure of £48,500, which would not only wipe out the surplus of £43,548 handed to the Common Good as a result of last year's working, but would leave a deficit of nearly £5,000.

Replying to a request by the Springburn Ward Committee, the Tramways Committee of the T.C. has informed the applicants that, in view of the difficulties under which the day service of cars is at present maintained, it is impossible for the department in the meantime to accede to a suggestion for establishing a half-hourly all-night service on the principal car routes in the city.

YEAR'S WORKING.—The report of the tramway department shows traffic and sundry receipts for the financial year to the end of May at £1,137,336, as compared with £1,076,877. The expenditure is £773 442, including a sum of £80,437 for expenses on account of the European War. For renewal and depreciation the amount set apart is £174,407, and the surplus paid to Common Good is £43,548, as compared with £12,951 last year.

Leigh.—Owing to the rapid opening-out of new coal-fields in the Astley district, local authorities are to approach the South Lancashire Tramways Co. to press for the construction of tramways from Leigh through Astley to Boothstown.

London and South-Western Electrification.—On Sunday last, trains started running on the Waterloo to Hampton Court section of the L. & S.W. Railway. This is the fifth section of the line to be electrified; only two sections, both running to Guildford, now remain to be completed. On the East Putney-Wimbledon route electric trains commenced running on October 25th last year, on the Kingston roundabout route and the Shepperton branch on June 30th, and on the Hounslow loop on March 12th. There will be trains every 20 minutes on the Waterloo-Hampton Court section.

Manchester.—The tramway department on Monday commenced an experimental half-hourly motor-'bus service from West Point, Slade Lane, car terminus to the Palatine Road car terminus.

Southend-on-Sea.—WAR ECONOMIES.—The Committee appointed by the Corporation to consider the question of effecting economies in public expenditure has considered the possibility of saving money by reducing the tramway service in any particular way, but is of opinion that this step would be inadvisable, both from the point of view of public service and that of economy, as the capital charges in respect of the service would continue whether the cars were in use or not. Regarding the staff at present engaged for the maintenance of the service, the Committee recommends the Corporation to dispense with the services of the traffic superintendent.

Walsall.—The Corporation Tramways Committee proposes to purchase three additional single-deck motor omnibuses, at a total cost of £3,187.

TELEGRAPH and TELEPHONE NOTES.

Australia.—According to the *Melbourne Age*, the Federal Arbitration Court commenced the hearing of the claim filed by the Australian Post and Telegraph Officers' Association against the Commonwealth Public Service Commissioner and Postmaster-General on April 27th. Claims were made for increased salaries for telegraph engineers and telegraphists, reduction of hours of duty, &c.

Holland.—It is reported that several private wireless installations have been seized at The Hague and confiscated by the authorities. The owners will be prosecuted.

Italy.—The automatic telephone exchange for 2,000 subscribers, installed at Rome some two years ago, has given such satisfaction to the Technical Commission supervising its installation and working that a proposal has been introduced into the Italian Parliament to replace all the existing manual exchanges by automatic exchanges. The example of the capital will, it is believed, induce the choice of that system for all future telephone installations throughout Italy.

New Cable.—A triple convention between Russia, China, and Autonomous Outer Mongolia, regarding a telegraphic cable to Outer Mongolia, has been published in Petrograd.

Post Office.—The Postmaster-General was to open the new head office of the London District Post Office Engineering Department, near London Bridge, yesterday.

Permanent male part-time London night telephonists, who have been employed for two years or more, have been granted 3s. a week increase, retrospective to February, 1914. These men now receive 18s., with 7s. a week war bonus, for 18 hours a week.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—U.D.C. Cable. See "Official Notices" to-day.

Aberdeen.—July 7th. Corporation. One 5,000-KW. turbo-alternator with surface condenser and auxiliaries, for the Electricity Department. See "Official Notices" to-day.

Australia.—PERTH.—July 19th. P.M.G. Supply of insulators (Schedule 510). See "Official Notices" June 9th.

August 16th. P.M.G. Distilling apparatus (Schedule 502), telegraph and measuring instruments (Schedule 498). See "Official Notices" June 16th.

MELBOURNE.—July 26th. Victorian Railway Commissioners. 400 signal lighting transformers.*

SYDNEY.—August 17th. Portable internal-combustion engine and dynamo (2½ KW.) for the Departmental Stores, Sydney, for P.M.G.*

August 24th. P.M.G. Automatic switchboard and apparatus for North Sydney Exchange. Schedule No. 511.*

BRISBANE.—July 31st. P.M.G. Power board and accumulators. Schedule No. 381.

Exminster.—June 29th. Electrical appliances for a year, for Devon County Lunatic Asylum. Mr. C. Masters, Clerk.

Liverpool.—June 26th. Electrical supplies to Toxteth Park B. of G. for three months. Mr. R. A. James, Clerk, 15, High Park Street.

Malvern.—Urban Council. Compressor for the electricity works. The Manager.

New Zealand.—INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office.

Rotherham.—July 3rd. Corporation. Twelve months' supply of tramway stores and materials, coal, cable, meters, &c. See "Official Notices" June 16th.

Salford.—June 26th. Corporation. Coal conveyors and bunkers, for the Electricity Department. See "Official Notices" June 16th.

Corporation Tramways. Manganese-steel crossings and steel tramway poles. General Manager, 32, Blackfriars Street.

Spain.—July 4th. Spanish Post and Telegraph authorities in Barcelona. Erection of an interurban telephone line between Igualada, Santa Coloma and Vallfogona, in the Province of Barcelona.

Warrington.—June 27th. (1) Coal elevator; (2) vertical steam boiler feed pump. Specifications, &c. (£1 1s. each, returnable), from Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer, Howley.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Accrington.—Electric lighting of Christ Church: Contract let to Messrs. Simpson, of Hapton.

Aylesbury.—U.D.C. Extension of battery at the electricity works: Chloride Co.

Bristol.—Electricity Committee. Contracts with the East Bristol Collieries, Ltd. (value £12,561), for coal to 30th September.

Glasgow.—The Tramways Committee recommends the following for acceptance:—

Scrap trolley wire, copper and mica turnings, scrap lead, scrap lead-covered cables.—MacKinlay, Ltd.
Scrap armature coils, scrap brass, bare stranded cables, D.C.C. copper wire, turnings and borings, scrap rubber and cables, dry cells.—R. M. Easdale & Co.
Wall plug-sockets, &c.—W. C. Yuille & Co.

The Electricity Committee has accepted the offer (£250) of Messrs. Waygood, Otis & Co. for a hoist for the showrooms in Sauchiehall Street.

Electricity Committee. Recommended tender:—

Babcock & Wilcox, Ltd.—Four sets of water-tube boilers for St. Andrew's Cross, £10,682.

Government Contracts.—List of new contracts for May, 1916 :—

War Office.

Electric cables and wire.—B.I. & Helsby Cables, Ltd.; Connolly Bros., Ltd.; W. T. Glover & Co., Ltd.; Hooper's Telegraph & India-Rubber Works, Ltd.; St. Helens Cable & Rubber Co., Ltd.
Conduits and fittings.—Simplex Conduits, Ltd.
Ebonite rod.—I.R., G.P & Telegraph Works Co., Ltd.; Peel-Conner Telephone Works, Ltd.
Generating sets.—Browett, Lindley & Co., Ltd.; Coventry Simplex Engines, Ltd.; W. H. Dorman & Co.; Norris, Henty & Gardners, Ltd.
Gutta-percha (sheet).—Craigpark Electric Cable Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Cryselco, Ltd.
Works services.—Electric light installation at Crambington: Robson and Coleman. Electric light installation at Lilbourne: G. Weston & Sons. Electric light installation at London Colney: Tredegars, Ltd. Machinery and plant for power house, Milton: R. Garrett & Sons, Ltd.; British Westinghouse Electric & Mfg. Co., Ltd.; D.P. Battery Co., Ltd.

India Office Store Department.

Cable.—Callender's Cable & Construction Co., Ltd.; W. T. Glover and Co., Ltd.
Plates.—Chloride Electrical Storage Co., Ltd.

Post Office.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.
Telegraph arms.—Siemens Bros. & Co., Ltd.
Telephone cable.—New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Porous cells.—I.R., G.P. & Telegraph Works Co., Ltd.
Insulators.—J. Bourne & Son; Bullers, Ltd.; Doulton & Co., Ltd.; J. Macintyre & Co., Ltd.; Taylor, Tunnicliff & Co., Ltd.
Telegraph ironwork.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; T. W. Leach, Ltd.; Portland Bolt & Nut Co., Ltd.
Bronze wire.—B.I. & Helsby Cables, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Annealed copper wire.—B.I. & Helsby Cables, Ltd.
Tinned-copper wire.—B.I. & Helsby Cables, Ltd.
Galvanised-iron wire.—Rylands Bros., Ltd.; Shropshire Iron Co.; F. Smith and Co., Wire Manufacturers, Ltd.

Wolverhampton.—Electricity Committee. Accepted tenders :—

H. Gough & Son.—Building extensions at the electricity works, Commercial Road, £3,620.
Stirling Boiler Co.—Two Stirling boilers and two superheaters, £6,406.
Underfeed Stoker Co.—Two sets of mechanical stokers, £1,907.
Crompton & Co.—Electric motor, £137.
Holly Bank Coal Co., Ltd., and W. Harrison, Ltd.—Fuel for use at the electricity works in stated quantities and at stated prices according to specification.

The Committee has confirmed the action of the chairman and the electrical engineer in placing an order with Messrs. Willans and Robinson for one turbo-alternator with condensing and auxiliary plant for £19,000.

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—Friday, June 23rd. At the Institution of Electrical Engineers, Victoria Embankment, London, W.C. At 10 a.m., Council meeting; at 10.30 a.m., annual general meeting.

Association of Supervising Electricians.—Tuesday, June 27th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Annual general meeting.

NOTES.

Organisation of British Engineering Industry.—Mr. F. Dudley Docker, C.B., chairman of the Metropolitan Carriage, Wagon, & Finance Co., Ltd., has joined the Committee of the Council for the Organisation of British Engineering Industry.

Educational Books for British Prisoners of War.—Arrangements have been made, with the approval of the Foreign Office, for extending to British prisoners of war interned abroad the benefits of the scheme, which has been in operation for the last year in connection with Ruhleben, for supplying selected books of an educational character to those of the interned who may be desirous of continuing their studies in any subject. Under this scheme several thousands of carefully selected volumes, mostly standard works, have been supplied to the Ruhleben Camp, which is now provided with excellent libraries (class, reference, and lending). These books, which have been sent out through the agency of officers of the Board of Education, have proved a great boon to the interned, and have enabled sustained educational work of a definite character to be carried on by the Camp Education Department formed among the prisoners. In view of the value of the work, the Board of Trade (Marine Department) have decided to take it into account, in connection with their examinations for the certificates of competency granted by them to officers of the mercantile marine and the fishing service. Accordingly, arrangements have now been completed for recording the time spent by any prisoner interned at Ruhleben or Groningen in the study of nautical or other subjects.

An appeal is, therefore, now made for a plentiful supply of new or secondhand books of an educational character (light literature and fiction is available from other sources) to meet the needs of the many thousands of British prisoners interned in enemy or neutral countries. It is to be hoped that to this appeal there may be a liberal response. A circular explanatory of the educational book scheme can be obtained by sending a postcard addressed to Mr. A. T. Davies, at the Board of Education, Whitehall, S.W., who is in charge of the arrangements.

Electricity and Rainfall.—In a recent issue (May 27th) of the *Scientific American* there is an illustrated article on the anti-hailstorm guns in general use to-day in the south of France, principally in the wine-growing districts of Bordeaux, Bourgogne, and the Champagne. The gun was originally invented by an Austrian of the name of Stieger, in 1896. It is discharged vertically through a funnel against the storm cloud, the discharge producing a whirling vortex of air which, according to M. Vermoret, a French expert, brings about certain changes in the atmosphere. The condensation produced by the discharge—we are told—modifies the unstable electrical state of the clouds which form the seat of the hailstones so much feared by agriculturists, especially winegrowers. The American paper is evidently not satisfied with the explanation of the action of the anti-hailstorm "cannon," but states that "this odd artillery is serving its purpose very well." Another American paper, the *Amerikai Magyar Népszava*, published, a short time ago, a letter, dated April 5th, from its Budapest correspondent, containing the news that M. Vozáry, a Hungarian engineer, had been experimenting among the vineyards in the mountains round Buda with an electric apparatus, with the object of dissipating storm clouds. On two or three occasions the apparatus had failed, and rain fell copiously, but the inventor's explanation was that his apparatus was not powerful enough, and that the current was only placed at his disposal in the day time. In scientific circles the invention is treated very much in the same way as was the anti-hailstorm gun at the outset, but the correspondent understands that the Ministry of Agriculture is inclined to have M. Vozáry's electric apparatus examined and reported on by experts.

It is somewhat singular that while Mr. Balsillie, with the assistance of the Australian Government, is making experiments with a view to inducing the fall of rain by electrical means, the Hungarian scientist is trying to prevent it by the same agency. From what is known regarding the phenomena, it would appear far more probable—or less improbable—that electrical discharges would precipitate moisture than the contrary, and therefore Mr. Balsillie's chances of success seem the more favourable.

Germany's Lack of Saltpetre.—The *Münchner Neueste Nachrichten*, in discussing a project of a Munich engineer, Herr Hallinger, for the utilisation of water powers with little fall for the production of electricity, makes some valuable admissions as regards the lack of saltpetre, for the manufacture of which the new scheme is especially intended. It says that the imports of saltpetre to Germany amounted to 774,000 tons in 1913, of which no less than 700,000 were used in agriculture. During the war large Government works had been started to ensure the supply of saltpetre for military purposes, but the supply for agriculture was cut off altogether as regarded Chile, and from Norway only 60,000 tons could be imported. According to agricultural statistics, soil fertilised with saltpetre produces four times the yield that it does without it. If this is correct, the coming harvest must fall by 2 to 3 million tons below the previous annual average. The scheme of Herr Hallinger is, therefore, to be taken in hand immediately, and will be discussed shortly in the Bavarian Landtag. The Bavarian Government itself is meanwhile making preliminary investigations as to the water power that may be available in Bavaria. According to Herr Hallinger, it would take one-and-a-half to two years to carry out his plans.—*Financial Times.*

Steel Shortage in Australia.—According to a Sydney newspaper, representatives of unions whose members are engaged in the iron and steel industry waited on the Assistant Minister for Defence (Senator Gardiner) at the end of April, and pointed out that the shortage of materials in the industry was causing much unemployment. They urged that action should be taken by the Federal Ministry to provide supplies. Mr. Thompson Green (South Australia), said that the shortage of material was causing grave concern to both employers and employés. Unless something were done in the near future, there would be a general stoppage of the works. Prices had risen from 80 to 100 per cent. since the outbreak of war, and were still rising. Shipping was controlled by the Federal Ministry, and arrangements should be made so that ships coming to Australia to take wheat cargoes should bring out materials needed for manufactures. Mr. R. O'Halloran, representing the Victorian Boilermakers' Union, said that if something were not done to relieve the situation something like 2,000 men would be thrown out of employment.

A short time ago the Prime Minister of Australia (Mr. Hughes) introduced a deputation of zinc producers in Australia to the Secretary of State for the Colonies, Mr. Bonar Law, to lay definite proposals before the Government. The deputation owned and controlled all the zinc ores produced in Australia. The scheme was Imperial in its scope and objects, and at the same time rested on sound business lines. It covered a proposal for the erection of smelting works in Britain, and involved the exclusion of German spelter after the war. The scheme, as ready for adoption, provided for preferential treatment of the Empire's products, but also allotted a fair share of raw materials to France and Belgium.

Swedish Export Prohibitions.—The Swedish Chamber of Commerce for the United Kingdom, London, has received a cable from the Swedish Board of Trade, Stockholm, to the effect that the following articles have been added to the list of goods which are now prohibited for exportation from and for transit through Sweden :—Electrical safety appliances, box current regulators, with coverings or inner parts of other metal than iron; mountings for incandescent lamps, with coverings or inner parts of other metal than iron.—*Morning Post.*

Contact Resistance of Metal Electrodes.—In a paper on this subject, read before the American Electrochemical Society, Mr. N. K. Chaney refers to the high "contact resistance" which, under certain conditions, exists between the surface of an electrode of sheet zinc and the electrolyte. This "contact resistance" between zinc and an electrolyte of zinc chloride and ammonium chloride is a secondary development occurring with measurable rapidity after the immersion of the zinc in the electrolyte. At the instant of immersion it is very small. It may rise to values of from 200 to 400 ohms per square inch of electrode surface. It forms the principal part of the internal resistance of dry cells at low current values, and as determined by measurements upon the latter it has a high temperature coefficient, decreasing to one-tenth of its value with a temperature rise of from 0° to 45° C. It is lessened or destroyed temporarily by current densities above certain low limiting values, but is practically unaffected by currents of less than 1 milliampere per 50 sq. in. of electrode surface, even if continued for a considerable time. With higher current densities it begins to decrease rapidly, and becomes negligible at current densities of about 1 ampere per 50 sq. in. On open circuit the resistance again slowly rises towards its initial value. It is destroyed or very greatly reduced by chemical treatment of the zinc surface, *e.g.*, by corrosion with dilute sulphuric acid. An explanation of the high contact resistance observed is based upon the supposed existence of a hydrogen film upon the electrode surface, discharged there by local action between the zinc and the electrolyte. This is supported by a considerable amount of experimental evidence, in which it is shown that the predicted behaviour of such a hydrogen film under selected conditions is in agreement with the observed behaviour of the contact resistance.—*Met. and Chem. Engineering.*

Testing Rubber Insulation.—In testing rubber insulation according to the Underwriters' specifications, Mr. A. A. Ladon found that samples taken from the same coil showed marked variations in strength and elongation. Samples 5 in. long were rolled between two blocks of wood to loosen the insulation; the rubber could then be slipped off the wire. The insulating material was then tested for elongation, stretch, and tensile strength. The results varied as much as 100 per cent., and in only six coils out of 52 did the samples check.

The trouble did not lie in non-uniformity or deterioration of the rubber compound, as was at first supposed. The method of separating the wire from the insulation was at fault. No matter how carefully the samples were rolled between the two blocks, the insulation could not be removed intact. In places it would stick to the wire.

A new method was therefore devised for removing the insulation. The wire was of tinned copper. Tin amalgamates with mercury very easily and forms a very slippery surface on the copper. The mercury has no effect on the rubber compound. About ¼ in. of insulation was cut off each end of the samples, and the stripped wire was scraped to remove dirt and grease. The ends of the samples were then immersed in mercury. After a period of time, varying from four to 24 hours, the insulation could be slipped off the wire with almost no effort.

This method is being used by one of the largest electrical manufacturers in the country. Besides the accuracy and uniformity of results accompanying the application of this property of mercury, the cost of the testing has been reduced by over one-third.—*Met. and Chem. Engineering.*

Russian Electricity Tax.—On May 20th, with the Assistant Minister of Finance, A. I. Nikolaienko, in the chair, a sitting of the Committee of Indirect Taxes was held. The consideration of the project for taxing electricity was taken in detail. The most important decision of the Committee was the acceptance of the proposition of the representatives of the electrical industry, that the concern delivering electricity should be free of the obligation to submit to the inspection of the Excise a list of its subscribers using current. The payment of the Excise or tax will be made according to the quantity of energy delivered, and not according to the amounts paid by the clients. The Committee agreed to certain exemptions in various branches of the industry. It ruled out the projected right of the officials of the Excise to enter the premises of the subscribers at any hour of the day or night, and agreed to permit inspection by the Excise officers in private premises only during certain fixed hours of the day.

Niagara Electrochemical Works.—Unable to obtain a sufficient quantity of cheap electric power from the Niagara Falls generating companies, when millions of cubic feet of water are being wasted over the great cataract every 24 hours, the Union Carbide Co., of Niagara Falls, N.Y., has been forced to erect a $2,000,000 branch plant at Sande, Norway. Construction work has already been started. The Norwegian factory will be known as the Electric Furnace Products Co.; it will be operated as a subsidiary of the Niagara Falls plant, and the products of the foreign company will be sold exclusively in the United States. The plant is expected to be in operation in less than two years.

Practically all the large Niagara Falls electrochemical industries are constructing extensive additions to their plants, and are continually increasing their demand for power. Probably the largest construction work now in progress is the plant of the Niagara Smelting Co. This new industry will be one of the largest users of electric energy along the Niagara frontier. Upwards of $1,500,000 is being invested in the new plant.

The new plant of the Hooker Electrochemical Co., costing upwards of $1,000,000, is rapidly nearing completion, and the Aluminium Co. of America has just awarded contracts for a large addition to its Falls plant. Other electrochemical industries are also making large extensions.—*Electrical World.*

Conductors and Flexible Cord in Russia.—Since October last year a scarcity of conductors and flexible cord for electrical installations has been felt in Russia, as the stocks that were in hand have become exhausted, and it has been found impossible to renew them under the existing conditions. Inability to obtain the necessary conductors and flexible cord for factories working for the national defence often brought about a difficult situation, particularly in the provinces, and this circumstance prompted the Electrotechnical Section of the Central Military Industrial Committee to call a special council of representatives of all the cable factories, in order to take measures for the purpose of remedying the trouble. The meeting took place on Friday, 8th/21st January, on the premises of the section, under the chairmanship of Prof. A. A. Veronoff, and considered the necessity of urging the Government to grant facilities for the delivery into Russia from abroad of a certain quantity of copper, rubber, and other necessary materials for the organisation in cable factories of the production of conductors and flexible cord for stock, provided that conductors and flexible cord should be delivered from store only to such concerns as were working for defence, and under a sufficient guarantee. For the coming half-year, according to the estimates of the Electrical Section, about 750 tons of copper will be required for Government purposes, the distribution of which and corresponding quantities of other materials necessary for the production of conductors and flexible cord, and also the control of the regular delivery of all these materials, it is proposed shall be entrusted to the Electrotechnical Section of the Central Military Industrial Committee. Representatives of the cable factories explained at the same time that with an immediate delivery of the necessary materials for the preparation of conductors and flexible cord, installations might be organised only on condition that during the period of the war certain variations in the present system of making the cables and flexible cord should be permitted. The fact is that at certain cable factories at present all the braiding machines are occupied in preparing field telegraph cable, but at the same time the winding machines are empty. It was urged, therefore, as desirable that the winding instead of braiding of wire should be allowed. Another variation from existing construction consists in the application for flexible cord of thicker wires, which indeed reduces its flexibility; but it is possible, and in time of war should be permitted. Prof. A. A. Veronoff was given a copy of the minutes of the corresponding committee of cable factories which met in Moscow from December 29th to January 11th. The examination of these proposals to vary the existing types of conductors and flexible cord was entrusted to the electrotechnical section of the committee, composed of specialists in conductors, &c.—*Elektrichestvo.*

A 15,000-H.P. Motor for a Reversing Rolling Mill.—The Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa., has sold to the National Tube Co. the electrical equipment to drive a new 40-in. reversing rolling mill, which it is about to install in its plant at Lorain, O. This rolling mill, when completed, will be one of the largest in the country. The motor will develop 15,000 H.P., and will run at a maximum speed of about 120 R.P.M. Power will be supplied by a fly-wheel motor-generator set, which will be so controlled that the load on the power plant will be limited approximately to 3,000 KW. A similar equipment has been supplied to the Indiana Steel Co., which has purchased Westinghouse electrical equipment to drive and control a new 40-in. reversing blooming mill that is to be installed in its plant at Gary, Ind. In addition to these two units, the Westinghouse Co. is at present building the electrical equipment for four other reversing mills, two of which are of approximately the same size as those mentioned above.—*Elec. Rev. and W. Electrician.*

Terrestrial Magnetism.—The report of the Astronomer Royal for the past year states that the mean values of the magnetic elements at Greenwich for the past two years were:—

	Declination, W.	Horizontal force in C.G.S. units.	Dip (inductor).
1914	15° 6·3′	0·18518	66° 51′ 13″
1915	14 56·5	0·18494	66 51 58

Electricity on the Panama Canal.—According to the *Electrical Review and Western Electrician*, extensive changes have been authorised for increasing the capacity of the hydro-electric plant at Gatun, Panama Canal Zone. New turbine wheels have been ordered for the three turbo-generator sets, each of 4,400 H.P., instead of 3,100 H.P. as at present. "No change will be made in the generators, as the very liberal design of these units makes it possible to operate them with an output of 3,650 K.V.A., at 80 per cent. power-factor and 55° C. temperature rise." In other words, it would seem that a miscalculation was made in the design of the generators, which were guaranteed to give only 2,500 K.V.A. continuously with 40° rise, or 3,125 K.V.A. for only two hours with 55° rise.

In order to take care of the increased output of these generators, four new 400,000-circular-mil cables have been ordered for installation between the hydro-electric station and the Gatun sub-station. The present cables between these two points are 10 in number, and of No. 0000 size.

In addition, two 4,000-K.V.A. power transformers have been ordered for the Gatun sub-station. These are the largest transformers that can be installed in the existing compartments.

One of the present 2,667-K.V.A. units will be moved to the Cristobal sub-station, where it will be needed to take care of the increased load, due to the operation of the new coaling plant, the terminal piers, and the projected submarine base.

Late Legal.—THE MAGNETA TIME CO., LTD.—An application in a debenture-holder's action—the Magneta Fabrique d'Horloges Electriques *v.* the Magneta Time Co., Ltd.—to confirm a provisional contract for the sale of the undertaking of the defendant company to a Mr. Molden, one of the co-plaintiffs in the action, came before Mr. Justice Astbury, in the Chancery Division, on Wednesday. Mr. Vanneck said the application had been before Mr. Justice Neville, when the contract was strenuously opposed, and his Lordship then adjourned the application, with the intimation that the provisional contract would be sanctioned at the adjourned hearing unless in the meantime a better offer was brought forward. The opposition of the company was that the price the applicants were to get for certain of the assets was not sufficient, and that the company would be able to realise to better advantage and save something for themselves, whereas under the provisional contract they would get nothing. The defendants did not now appear on the application, and the applicants had had no notice of any other offer being made, and counsel understood they did not intend to oppose the contract any further. Mr. Justice Astbury thereupon sanctioned the contract.

The British Engineers' Association.—The following communication has been issued to British engineering firms, under date June 19th, from the offices of the Association, 32, Victoria Street, Westminster, S.W.:—

"As president and chairman of the Executive Committee of this Association, we appeal to you at a critical moment for your support and co-operation.

"The war is often described as an 'Engineers' War,' and there can be no question as to the vital part played by the British engineering industry.

"One result of the honourable, but heavy, responsibility which was thrust upon our engineers on the outbreak of war has been the inevitable dislocation of our pre-war trade and manufacture. As a consequence, the future contains serious problems which can only be solved by the ablest brains in the engineering trade.

"The first practical step—as in all struggles on a large scale—is mobilisation. It is notorious that neither in peace nor during the war has the British engineering industry exerted the influence to which it is legitimately entitled.

"The cause of this serious handicap has been the failure to combine. The disinclination to combine was due to British individualism and independence. But we would ask you to consider whether the dictates alike of patriotism and business do not call for combination on a large and effective scale in so far as it is vital to secure a national policy which will conserve and foster British engineering.

"If we lean on Government departments or outside helpers and advisers instead of looking after our own interests for ourselves we shall—as the past has proved—be running grave risk.

"We fully realise the strain and pre-occupation imposed upon you by the war, but the issues at stake are too urgent to be any longer side-tracked till 'after the war.'

"It is common knowledge that Germany, and, perhaps, other rivals, are preparing for a vigorous commercial campaign at our expense on the cessation of hostilities. If Germany can do this, so can we. The question is merely one of inclination. The British are the best organisers in the world, as witness the Royal Navy and our Army of 5 million men. They are also the easiest people to organise, once their consent has been won, because they are a free people.

"The time has come for the engineering industry to show the country that it believes in organised self-reliance, and that it is prepared to maintain the supremacy of British engineering against all-comers.

"The first practical step towards this end is mobilisation. We, therefore, appeal earnestly to you to join forthwith the 300 firms which already belong to the British Engineers' Association, so that we may henceforward present a united front to our common enemies whoever and whatever they may be.

"The new members whom we hope to welcome will naturally have a say in the coming campaign; and, in order to reduce the call upon the time of busy men to a minimum, we have engaged the services of special organisers to carry out the decisions of our Council and Executive Committee.

"We believe that we are justified in promising you in the near future a practical return for your support, and we shall heartily welcome your criticisms and suggestions.

"WILFRID STOKES, *President*.
"J. E. THORNYCROFT,
"*Chairman of the Executive Committee*."

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday last week the special meeting of Corporate Members was held to confirm the resolution to alter the Articles of Association, so as to exclude alien enemies from membership. The resolution was passed with one dissentient. In proposing a vote of thanks to the President, Mr. Ll. B. Atkinson pointed out that the Council had been unable to move in the matter until it was called upon to do so by the members; but directly that step had been taken, the President and Council had acted vigorously and effectively.

Association of Teachers in Technical Institutions.—On Saturday last Dr. Wm. Garnett delivered an address on "Technical Instruction after the War" at the annual conference of the Association. He said that when the full record of the work done for Government departments by Universities and technical colleges could be made public, it would command the attention of the industrial world, and there would no longer be any need for the work of Committees on the neglect of science. He advocated the formation of associations of manufacturers in allied trades to ascertain the subjects on which research should be undertaken. We had been so keen on dealing in the cheapest markets that we forgot all national considerations; no sacrifice was too great in the way of market price to render this country industrially independent of all other nations in respect of the essentials of life and of national efficiency.

Reform of the teaching of the schools could never be effected except through the examinations, on the results of which schools gained their position in public esteem.

Amongst the special points that Dr. Garnett emphasised were the following:—

(1) That leaders of industry must place a higher value on individual scientific research, which is the greatest need of British industry. (2) That teachers in technical institutions must be more closely associated with industrial leaders. (3) That time and other necessary facilities must be given to teachers in technical institutions to enable them to carry out industrial research. (4) That consumers must be willing to make a sacrifice in order to contribute to the nursing of infant industries, so as to avoid entire dependence on foreign sources for the necessaries of life or civilisation.

The Chemical Society.—At the adjourned special general meeting of the Society, on Wednesday, a resolution was carried to remove from the list of honorary and foreign members the names of nine alien enemies, including those of Nernst and Ostwald.

The Electrical Trades Benevolent Institution.—Mr. F. B. O. Hawes, secretary of the above institution, informs us that the confirmatory general meeting was held on the 19th inst., at the Institution of Electrical Engineers, for the purpose of confirming the alterations in rules which were made at the annual general meeting. The principal alteration was to make the rule regarding the position of members who had not paid their subscriptions slightly less drastic than it formerly was. The rule formerly stated that members whose subscriptions were in arrear were entitled to no privileges whatever. The altered rule is, that a member who is thus in arrears shall not be entitled to votes. Mr. Hawes adds:—"There is no doubt that votes will in the near future be of considerable value, as the election of pensioners is by vote, and the list of members is steadily embracing more names of persons who might possibly be in need of such pensions. It is sincerely to be hoped that the list will contain many more such names in the near future."

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, June 26th.—Technical for Platoon No. 9, 46, Regency Street, S.W.; Squad and Platoon Drill, Platoon No. 10; Signalling Class and Recruits.

Tuesday, June 27th.—The School of Arms will be discontinued during the summer months; Recruits, 7.15 to 8.15.; lecture, 7.15, "Organisation and Discipline," Company Commander W. Hynam.

Wednesday, June 28th.—Platoon Drill, No. 1 Platoon.

Thursday, June 29th.—Platoon Drill, No. 5 Platoon; Shooting for No. 9 Platoon; Miniature Range; Recruits, 5.45 to 7.45; Instructional Class, 5.45.

Friday, June 30th.—Technical for No. 10 Platoon, 46, Regency Street, S.W.; Squad and Platoon Drill, No. 9 Platoon.

Saturday, July 1st.—Parade, 2.45. Uniform.

Sunday, July 2nd.—Entrenching duties: Parade, Victoria (S.E. and C. Railway Booking Office), 8.35 a.m.

MACLEOD YEARSLEY, *Adjutant*.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, June 22nd, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Wembley Park at 3 p.m. for Drill under the Commandant.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties.

Battalion Sergeant-Major's O.I.C. Class will be examined by the Commandant on Saturday, 24th inst., at 3 p.m., at Wembley Park. A new class will commence on Monday, the 26th, at Lord's Cricket Ground, at 5.30 p.m., and will continue for two months. Names should be sent in to the Adjutant as soon as possible.

Map Reading.—Mr. W. Page will commence a new class at Headquarters on Wednesday, 28th inst., at 5.30 p.m. Those who wish to attend should send in their names to the Adjutant as soon as possible.

Musketry.—Competitors for the "Holland Cup" and other members who have sent in their names to shoot at Bisley on Sunday, 25th inst., will report in uniform to Sergeant J. W. S. Burmester, at 9.45 a.m., at No. 8 Platform, Waterloo Station.

G. H. F. DUNCAN, *Acting Adjutant*, O.B.C.

Fatalities.—A young machineman was examining a machine with the aid of an electric lamp in the Speedwell Iron Works, Coatbridge, when he sustained a shock which proved fatal.

A verdict of "Accidental death" was returned at a Kilburn inquest, on Saturday, on Walter Percy Harris, 33, an electric fitter, of Kensington, who was killed on June 15th. According to the *Daily Telegraph*, it was stated in evidence that Harris was employed by the British Westinghouse Co., Ltd., at the electric substation of the London and North-Western Railway Co., at Kilburn. He was engaged in connecting some cables, and as there was an obstruction, he went to a cubicle containing live wires with the object of finding out what the obstruction was. He had been warned of the danger. It appears that he struck a spanner against

a live wire at the top of the cubicle, and he received a shock of 11,000 volts. The jury added a rider to their verdict to the effect that greater care should be taken in guarding live wires.

Appointments Vacant.—Mains engineer, fitter drivers, engine drivers, and wiremen for the Military Electric Power Stations, Southern Command, Salisbury; junior assistant (30s.) for the Leek U.D.C. electricity works; station engineer, assistant engineer, charge engineer, station fitter, and linesman jointer, for the Ripon military camp. See our advertisement pages for particulars.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Official.—Mr. R. M. WILSON, late assistant superintendent at the Thornhill power station of the Yorkshire Electric Power Co., Ltd., who is leaving to take up a position with the Ebbw Vale Steel Works Co., has been presented by his colleagues with a gold albert.

General.—At a largely attended social gathering, the South Shields Corporation tramways department presented a silver cigarette case and a silver watch to Motor-man WILLIAM MIDDLETON, who was serving on one of the warships which took part in the naval battle off Jutland. Mr. W. Bunting presided, and Alderman Wylie, chairman of the Tramways Committee, made the presentation.

Mr. JOHN BROTHERTON, manager of the British Insulated and Helsby Cable Works, Helsby, has been placed on the Commission of the Peace for Cheshire.

Mr. E. A. NASH, secretary of the Faraday House Testing and Training Institution, has joined the Artists' O.T.C.

Roll of Honour.—Captain HENRY NEWTON, of the 5th Notts and Derbyshire Regiment (attached to the Royal Engineers), who is a director of Messrs. Newton Bros. (Derby), Ltd., electrical engineers and contractors, of Derby, has been awarded the D.S.O. According to the *Derby Daily Telegraph*, Captain Newton accompanied the Ilkeston Company of the 5th Battalion (T.F.) to the Front, and while there he was responsible for a number of inventions which were used to advantage by his own Battalion, and the Brigadier-General, realising their excellence and utility, gave instructions for them to be provided for the Brigade. A workshop, which now employs over 1,000 men, was established in France for his operations to be conducted on the spot, and Captain Newton was placed in command. It is stated that the King, the Prince of Wales, and the late Lord Kitchener all evinced great interest in his inventions.

Lieutenant F. DIXON, Dorset Regiment, an electrician under the Cleckheaton Urban Council, has been wounded.

Sapper EDGAR LOCKWOOD, of the 13th Divisional Company of the Royal Engineers, a member of the Institution of Electrical Engineers, aged 28 years, and formerly engaged at the Ashton-under-Lyne electricity works, has died of disease contracted on active service.

Private ERNEST BARKER, of the Lancashire Fusiliers, for nine years in the employ of the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, has been killed in action.

Private J. H. LEONARD, of the King's Liverpool Regiment, who has been missing since June, 1915, is now officially presumed killed. Prior to enlistment he was employed at Messrs. Dick, Kerr & Co.'s works at Preston.

Electrical Artificer J. W. HORNER, formerly on the electrical staff of the North-Eastern Railway Co. at York, was on *H.M.S. Warrior* in the North Sea battle, and was injured. He is in a Scottish hospital, and is making a good recovery.

Private THOMAS BURNS, Loyal North Lancashires, has died from wounds in the head received whilst fighting in France. He had worked previously as an electrician.

Lieutenant H. DUNCAN, of the Royal Flying Corps, formerly in the testing department at the Rugby works of the British Thomson-Houston Co., Ltd., has been decorated by the King with the Military Cross for services rendered at the Front.

Air Mechanic ERNEST WHITFIELD, of the Royal Flying Corps, who has died of smallpox whilst on active service at Cairo, was formerly on the Doncaster municipal electricity works staff.

E. R. L. SNOW, who was a wireman on board *H.M.S. Invincible*, lost his life in the North Sea battle.

Electrical Artificer HARRY WOODMAN was lost in the North Sea fight on board *H.M.S. Queen Mary*.

Our readers will, we are sure, join us in tendering sincere sympathy to Mr. R. A. Chattock, city electrical engineer of Birmingham, on the death of his only son, Private A. A. CHATTOCK, who was killed in action on June 4th. Private Chattock, who was 23 years of age, was educated at Hillbrow School, Rugby, and subsequently at Charterhouse School (Robinites). He studied at the Birmingham Municipal School of Art and in Paris. He was engaged on designing work when war broke out, and he joined the 2nd City of Birmingham Battalion in October, 1914, as a private. This was afterwards named the 15th Service Battalion Royal Warwickshire Regiment. The Battalion went to France in November, 1915, and he was on active service there until his death occurred.

Lance-Corporal EDWARD MEE, of the Loyal North Lancashires, on the Bolton tramways clerical staff, has been missing since May 21st.

Obituary.—MR. E. MARCH WEBB.—We regret to record the death, which occurred somewhat suddenly on June 15th, at the Arundell Arms Hotel, Lifton, Devon, of Mr. E. March Webb, of the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd. Mr. March Webb commenced his career at Silvertown in 1869, on the staff of the late Sir Charles Bright, during the manufacture of 4,000 odd miles of submarine cable for the West India & Panama Telegraph Co., which was laid in 1870. Subsequently Mr. Webb joined the Silvertown company, and took part in many cable-laying expeditions as chief electrician between 1872 and 1895. He was at one time manager of the West Coast of America Telegraph Co., Ltd., and lately he had filled the office of secretary of the Spanish National Submarine Telegraph Co., Ltd. The cable-laying expeditions in which he took part were as follows:—The Direct Spanish cable (1872); Havana-Key West (1873); Newhaven-Dieppe Shore End (1874); Chile-Peru cables (1875); Marseilles-Algiers laying and Direct Spanish repairs (1879); Lizard-Bilbao (1880); Marseilles-Algiers (1880); Mexican cables and Havana-Key West repairs (1880); C. & S.A. cables (Pacific side) (1881); Spanish National cables (1883 and 1884); Havana-Key West repairs (1886); Congo cable repairs (1887); Western and Brazilian (1891); South American Co. (1892); ditto (repairs) (1893); Spanish Government and S.A. (1895). His death is regretted by his remaining Silvertown friends as the loss of one who was kind-hearted and genial to all.

MR. WILLIAM TODHUNTER.—We regret to record the death of Mr. William Todhunter, of the Telegraph Construction and Maintenance Co., Ltd., which occurred at Blackheath on June 19th, at the age of 59 years.

MR. J. TRANTER.—The death is announced of Mr. Joshua Tranter, of Kendal, who, under the National Telephone Co., inaugurated the service at that town 20 years ago. Later he had charge of the underground installation work at Blackpool, Lytham, and St. Annes, and he retired when the undertaking came under Government control. He was 71 years of age.

NEW COMPANIES REGISTERED.

L. Weekes, Ltd. (144,093).—This company was registered on June 14th, with a capital of £10,000 in £1 shares (1,000 founders'), to take over the businesses (1) of an electric fuse manufacturer carried on by A. L. Weekes at Langley Street, Luton, Beds., as the British Electric Calibrated Fuse Co., and (2) of electric switch manufacturers carried on as the "Safetee" Controlling Appliances Co., Ltd., at Langley Street, Luton. The subscribers (with one share each) are: A. L. Weekes, Brooklands, Harpenden, Herts., gentleman; W. J. Coom, 30, Conway Road, Luton, Beds., engineer. Private company. The number of directors is not to be more than five; the first are: A. L. Weekes (permanent chairman and sole governing director) and W. J. Coom. Qualification, £100. Registered office: Langley Street, Luton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bourton-on-the-Water Electric Light & Power Co., Ltd.—Particulars of £600 second debentures created August 27th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £580. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Rural Electricity Supply Co., Ltd.—Issue on June 6th, 1916, of £100 debentures, part of a series of which particulars have already been filed.

South Metropolitan Electric Light & Power Co., Ltd.—Issue on May 24th, 1916, of a £20,000 debenture, part of a series (this debenture, with others, particulars of which have already been filed, is issued to trustees as security for an issue of debenture stock).

T. W. Broadbent, Ltd. (95,420).—Capital, £5,000 in 440 pref. and 560 ord. shares of £5 each. Return dated August 27th, 1915 (filed April 22nd, 1916). All shares taken up; £5,000 paid. Mortgages and charges: £1,000.

British Mica Co., Ltd. (72,187).—Capital, £5,000 in 2,000 pref. and 3,000 ord. shares of £1 each. Return dated March 16th, 1916. 629 pref. and 2,000 ord. shares taken up; £629 paid on the pref.; £2,000 considered as paid on the ord. Mortgages and charges: Nil.

Camborne Electricity Supply Co., Ltd. (57,950).—Capital, £10,000 in £1 shares. Return dated April 26th, 1916. 607 shares taken up; £605 paid, leaving £2 in arrears. Mortgages and charges: Nil.

CITY NOTES.

Paris Metropolitan Railway.

The report for 1915 of the Compagnie du Chemin de Fer Métropolitain, of Paris, refers at length to the tunnel and incidental works carried out by the City of Paris in connection with the extensions of the railway, and states that no routes were handed over to the company for the construction of the permanent way and

equipment for working. Although delays had taken place in consequence of the difficulty of obtaining labour and materials, progress had been made everywhere. Similar obstacles confronted the company in the execution of its works, and the route length in operation had not varied since September 30th, 1913, the mileage slightly exceeding 48. The completion of the orders placed in 1913 for additional motor cars and trailers had been interrupted, and the rolling stock consequently remained at 700 motor cars, 270 first-class trailers, and 335 second-class trailers. The train service, which had to be reorganised and reduced in the second half of 1914, was gradually brought last year up to a time-table which substantially approached that which prevailed prior to the war, whilst the number of employés had risen from 3,658 at the end of 1914 to 4,133 at the close of last December. Concerning the bonuses granted to the staff in order to give the men a greater interest in the efficient working of the railway, the report mentions that over £36,000 was paid in this manner in 1915, and both the regular men and the temporary substitutes for those called to the Colours participated in the distribution. The total receipts amounted to £1,846,000, of which £596,000 represented the share payable to the City of Paris according to the terms of the concession, and the working expenses absorbed £806,000. After making various appropriations, the net profits are returned at £252,000, which sum has permitted of the declaration of a dividend at the rate of 5.6 per cent. on the ordinary capital of £3,000,000.

Imperial Tramways Co., Ltd.

The directors, in their report for the year ended December, 1915, state that the gross receipts of the Middlesbrough, Stockton and Thornaby electric tramways amounted to £66,529, an increase of £2,967. The passengers carried were 12,299,280, an increase of 37,656. The net profit was £15,432, as compared with £17,604. The traffic receipts continued to develop in spite of the difficult conditions in the districts served by the tramways and omnibuses. Since the beginning of the war 84 per cent. of the employés have joined the Forces or attested. The special allowances granted to dependents of employés amounted during 1915 to £1,531. This company holds £22,230 5 per cent. cumulative preference shares of £1 each and 112,451 ordinary shares of £1 each in the London & Suburban Traction Co., Ltd., and has received the full dividend for the past year on the preferences shares, but the revenue of that company for the year 1915 was not sufficient to permit the payment of any dividend on the ordinary capital. The company's net revenue account for the year shows an available balance of £25,760, and after payment of interest on the debenture stock for the whole year an interim dividend on the preference shares in respect of the half-year to June 30th last, amounting together to £17,075, 6 per cent. per annum on the preference capital (less income-tax) absorbs £5,025, and a dividend for the year at 2 per cent. on the ordinary capital (less income-tax) requires £3,467, £194 remaining to be carried forward. Annual meeting: June 26th, Bristol.

United Electric Tramways of Monte Video, Ltd.

Mr. G. A. Touche, M.P., presiding at the annual meeting on June 15th, said that the war was still a dominating factor in the River Plate. The company suffered from the abnormal conditions in the shipping world, and would do so more in the current year. Practically all materials required by them had to be shipped to Monte Video. The coal situation continued to cause anxiety. There was no coal supply in Uruguay, but there were fairly extensive peat deposits, and experiments as to their use for fuel purposes were being made. Failing British coal, it became necessary to rely on America, although it was not of the same steaming qualities as Welsh. The large railway companies and other consumers of coal in the Argentine and Uruguay had formed a committee to regulate, as far as possible, the exportation of coal to the River Plate. The Admiralty had agreed to liberate a certain amount of requisitioned shipping to carry coal from American ports to the River Plate. The cost of this coal, delivered in Monte Video, would be approximately 105s. per ton, of which 85s. represented freight. This compared with an average pre-war price of 40s. 6d. British coal might cost even more, but at the moment there was little or no chance of obtaining any. It was by no means certain that the company's requirements, even in American coal, would be fully supplied, as it was very difficult to find the ships necessary to carry it south. The fuel difficulty had not reached its acutest stage during the period covered by the accounts, but during the year now current it must represent a serious charge on the company's receipts. Weather conditions in Monte Video had also been unfavourable again. By carrying out rigid economies in every department of the hotel, the reduction in the expenses almost compensated for the decrease in the receipts. All these adverse circumstances made a rather depressing narrative, but none of them represented conditions which should be permanent. Having referred to the political and economic situation in Monte Video and given details of the results of the past year's working, the chairman expressed regret that the directors were unable to recommend the payment of any dividend on the ordinary shares. In the circumstances, there was no prudent alternative. With regard to the current year, weather conditions during the past summer season showed some improvement, with the result that the traffics had shown increases when compared with the corresponding months in the previous year. It was, however, to be regretted that practically all the increase in gross receipts had been absorbed by heavier operating expenses. Those expenses were bound to go on increasing while fuel and freight costs continued on the up-grade. He feared they could not expect any improvement in the net revenue position in the current year unless conditions made some rapid change. For some time past it had been the policy of the Government of Uruguay to municipalise businesses of public utility. With this object in view they acquired recently a controlling interest in the Norte Tramway Co., which still operated a system of trams in Monte Video by animal traction. He believed it to be the intention of the State to electrify this system and extend it in various directions—probably in competition with existing electric tramways. Experience showed that co-operation was better than competition, whether the result aimed at the public utility or financial stability. If the municipality was to enter upon the tramway business it would clearly be better that it should control the largest system in the city instead of being in competition with it. This might explain why some months ago informal inquiries were made as to whether this company would be prepared to sell to the State, and, if so, on what terms. The directors recognised that the position created by the war and the desire of the Government that British investments in North and South America should, when opportunity offered, be realised, were factors which ought to be taken into account. They therefore caused the authorities to be informed that if the Government were prepared to make a definite offer on a fair and reasonable basis of valuation, they would give it their serious consideration. Since the report was issued the Government had made a proposal, which the directors would give their full and careful consideration.

German Netherlands Telegraph Co.

The report for 1915 of the Deutsch-Niederlandische Telegraphen Gesellschaft, of Cologne, states that no changes took place in the conditions of the company's stations and cables as compared with the preceding year, the cables being still in good condition. No news had so far come to hand from the officials who remained at Yap in regard to this station, and the directors assumed that the Japanese censor had not permitted any report being made. The company had again received a dividend of 6 per cent. for 1914-15 on its investment in the German South Seas Wireless Telegraph Co. in so far as it was paid up. As a result of the alteration in the agreement with the Great Northern Telegraph Co., of Copenhagen, according to which the annual payment for repairs was reduced by £3,000 from June 1st, 1915, the German Netherlands Co. had to pay a sum lower in this year by £1,750, but a reduction in the expenses as against 1913-14 was not shown, owing to the unfavourable rate of exchange. The net profits are returned at £41,000, as contrasted with £41,600 in 1914, and the directors recommend a dividend of 6 per cent., as compared with 6½ per cent. in 1914.

German Electrical Companies.

The Elektrizitats Gesellschaft (late W. Lahmeyer & Co.), of Frankfort-on-Main, reports net profits amounting to £103,000 for 1915, as compared with £103,500 in the previous year. It is intended to pay a dividend of 7 per cent., being the same rate as in 1914.

The accounts of the *Land und Seekabel Werke, of Cologne-Nippes*, show gross profits amounting to £61,000 for 1915, as compared with £67,000 in the preceding twelve months. After setting aside £4,000 for depreciation, as against £12,000 in 1914, and making other appropriations, the net profits are recorded at £38,000, as compared with £35,000. It is proposed to distribute 11 per cent. on the paid-up capital of £262,500, this comparing with 10 per cent. in 1914.

The shareholders in the *Bergmann Elektrizitats Werke, of Berlin*, were informed by the general manager at the recent annual meeting that over one-half of the total turnover in 1915 represented peace manufactures, the balance comprising war contracts. As a result of the Government requisitions of copper and certain other metals, the company had been compelled to equip itself for the production of metal substitutes, and this had rendered it possible to continue the output of articles for peace purposes. This fact was also of importance for the period after the war in regard to the price movements in copper. If the price of copper exceeded permissible limits the continued use of substitutes would make the works independent of other countries. On the conclusion of peace it would be possible quickly to change over to the manufacture of peace products, and competition would be keen, especially with American firms.

Marconi International Marine Communication Co., Ltd.

Mr. Godfrey Isaacs presided, on June 14th, at the annual meeting, in the absence of Mr. Marconi in Italy. After dealing with the balance sheet and the increase in the receipts, which has already been mentioned in the report, he said that they were entitled to congratulate themselves upon the result, especially considering that the business was necessarily being conducted in very difficult and abnormal circumstances, and that the whole of the losses incurred through the submarine warfare had been debited to profit and loss account. The gross receipts, which in 1911 were £64,166, had grown in successive years to £100,325 (1912), £146,325 (1913), £175,105 (1914), £208,927 (1915). Their

telegraphic receipts were very much below what they would have been in ordinary circumstances. Except in such abnormal times as these their business was not subject to any material variation in its figures in consequence of fortuitous circumstances, activity or slackness of trade. They provided what was an absolute need, the great importance of which was more marked each year. Not only was it essential that every merchant ship should be fitted with a wireless installation, but overwhelming evidence had been afforded of the importance of a world-wide organisation such as the company had built up. The number of telegraph stations owned and worked by the company as public telegraph stations on the high seas had increased since December from 1,008 to between 1,100 and 1,200, and the number was increasing daily as fast as it was possible to turn out and fit the installations. They had to-day a sound industrial business which could only progress, and which, after the war, would develop more quickly than hitherto. Their position had not been obtained without a very great struggle. Since their inception, 16 years ago, they had encountered innumerable difficulties, the country was slow to appreciate the value of their work, and the business was dangerously near to falling into foreign hands. It gave one hope that the lessons of the war would lead to national assistance—should it again fall to the lot of a British company, situated as this company was—to develop a new science and a new industry destined to become of such paramount importance to the nation. Mr. Marconi's recent developments would dispose of one more peril of the seas. He authorised him to state that in the near future he would introduce a new, independent, and very simple apparatus to be worked from the bridge of a ship, and by one of the ship's officers, which should put an end to all danger of collision in darkness or fog. Mr. Marconi had described that new work to him, and he had little doubt that every seagoing vessel would be equipped with the invention. This should prove of no small value to their company. Mr. Isaacs went on to refer to the bravery in these perilous times of their operators, of whom they had 2,000 almost continuously on the seas. Eighty-two of their operators were employed on mercantile ships which had been sunk by the enemy. Three were drowned, two had been seriously injured, and seven slightly injured. The chairman spoke very highly of the services of the manager, Mr. Bradfield, and the heads of the ship department, Messrs. Cross and Lewis, and their staff.

J. G. White & Co., Ltd.—A dividend of 6 per cent., less tax, is proposed, carrying forward £34,939. The war continues to adversely affect the business. Methods for broadening the scope of the company's work are being developed with encouraging prospects. Investments having been conservatively valued in the past, no readjustment of values is now necessary.

Marconi's Wireless Telegraph Co., Ltd.—Gross profit for 1915, £581,125; net profit, £377,818, an increase of £145,101. In view of the state of war, and having regard to the large sums of money abroad, and to the uncertainty when the moneys due from the Government will be received, the resources are to be husbanded. A final dividend of 5 per cent. will make 10 per cent. for the year. Annual meeting: June 30th.

Trowbridge Electric Supply Co., Ltd.—Mr. J. H. Blake presided at the annual meeting, on June 13th, at which a dividend of 5 per cent. on the ordinary shares was declared. The profits were only £348, as against £438 last year. That was not due to a reduction in sales, but to their not putting up the price to consumers as early as they ought to have done. It was stated that the Bradley Road residents could not have a supply, as the Council would not grant permission there for overhead wires. The cost of underground cables was prohibitive, and would be for some years to come.

Waygood-Otis, Ltd.—For the year ended March, 1916, the profit was £12,798. Depreciation absorbs £3,900, directors' remuneration and salaries of directors managing departments £6,542, grants to employés' dependents £2,396, and there is carried forward £671.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Interim dividend of 3 per cent. on account of the accrued dividend on the 6 per cent. cum. pref. shares.

Veritys, Ltd.—Dividend for the year, 6 per cent. on the ordinary shares, carrying forward £1,084.

Coventry Chain Co., Ltd.—Interim dividend of 6 per cent. per annum, less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The capital news of the Russian advance contributed in no small measure to further improvements in the Stock Exchange markets, prices going ahead rapidly under the leadership of Consols. The Funds, indeed, moved much too quickly, as was apparent immediately the buying pressure became relaxed, with the result that the 4-point rise secured in less than a week was cut in half as sellers came in, tempted by the rapidity of the rush-up. Consols have once more taken the premier position as regards markets, upon them depending movements in other gilt-edged securities. The latter hardened with Consols, but in their case they managed to retain the rises considerably better than Consols did.

Home Railway stocks have dwindled a little, following upon their big rises of last week. The attention called to the market by the advances, spread to the Central London issues; though when would-be purchasers sent in their orders, they found scarcely any stock on supply, and the quotations nominal except to sellers. The 4 per cent. preferred stock is changing hands about 57½; but the 4 per cent. assented preferred stock is quoted about 72, with none on offer. The last business marked in the company's ordinary stock (non-assented) was at 35½, which is about half the present quotation for assented ordinary. Underground Electric ordinary are better at 1 15/16, though the income bonds have given way a little.

Electricity ordinary shares have a rise of 7s. 6d. to the credit of Westminsters, which has raised these to 6, at which price the return on the money comes to £5 16s. 8d. per cent. This gives Westminster ordinary the pride of place, as yielding less than any of the shares of its class in the list. Chelseas at 3 are ¼ down; up to the present they have held the position now taken by Westminsters. The highest returns are those afforded by the ordinary shares of the South London, the Brompton, and the London Electric Companies, in the order named; while from the preference shares the average yield works out to about 6¼ per cent., taking the list through. There is rather more business doing in the market than usual, and jobbers report inquiry for the shares of the leading companies. In the manufacturing group, too, Edison & Swans have picked up to half-a-guinea. British Westinghouse preference have further improved.

British Aluminium ordinary shares are a trifle easier at 26s. 6d. The report of the Aluminium Corporation, which had been awaited with considerable interest, is now out, and shows a net profit of £14,300, this being the first time for the past half decade that the company has escaped a loss. The preference shares are, therefore, to get their 7 per cent. dividend, although some criticism is directed against the payment by those who think it would have been better to fortify the financial position by refraining from making a distribution yet. Nothing has been allowed this year for depreciation, the directors stating that the question will be dealt with in the next report.

All the cable manufacturing shares are strong. India-Rubbers have risen 5s. to 11¾. Henleys and Callenders are wanted by Manchester, which also is a buyer of the other companies' shares in this group. Babcock & Wilcox gave way a trifle, but firmed up again to 2¾. Castner-Kellners have recovered the dividend recently deducted, and at 3⅜ they are 3/16 higher on the week.

With reference to dividends paid free of tax, as there seems to be a slight misapprehension amongst some readers, may we repeat that the yields per cent. which are given in our tables have been calculated without making any allowance for income-tax at all. For some time, we endeavoured to show the equivalent return where dividends were paid tax free; but, in consequence of the various alterations which took place and the different deduction made by the companies from their dividends, we reverted to the simpler practice of working out the returns "flat," leaving the necessary allowances to be made by those who are interested. To take one concrete example: The return on Eastern Telegraph ordinary stock comes to 5¼ per cent.; but as the dividends are paid free of tax, deduction of 5s. in the £ would render this equal to nearly 7½ per cent. when compared with other shares the dividends on which are subject to tax before the cheques are sent out.

The strength of the telegraph market continues to stand out as one of the features of the Stock Exchange. Westerns have risen 7s. 6d., Eastern ordinary is up 2 points, "China" shares are again up ½, and Anglo-American preferred is a point to the good. In addition to these, all the rises of the previous week have been held. Considerable animation has revived in Marconis. The ordinary shares gained 7s. 6d. upon their last week's price, but at 2 13/16 shares came in, and there was a small reaction which has left the price ¼ up. Rumour is busy in the discussion of what dividend the company is likely to pay. With the parent shares, those in the subsidiaries have also rallied, Americans hardening to 16s. 3d., and Canadians to 9s. A prominent feature in this section is the strength of Marconi Marines, which rose straight from 30s. to 39s. without a break, though at the latter price something of a halt was called to the breathless advance.

Mexican news is bad. Carranza has developed unexpected truculence, and is said to have seized a station on the Southern Pacific Railroad. President Wilson has ordered mobilisation of the American Militia, and prices of Mexican securities are naturally flat. So far as the utilities are concerned, no quotable changes have been made, but the various issues are not exactly in eager demand.

Holders of the 5 per cent. convertible debenture stock of the Consolidated Gas, Electric Light, and Power Co., of Baltimore, should note that their option of conversion into common

shares will expire on July 1st. The stock is an excellent security, but the shares have fine prospects, and receive 7 per cent. dividends at present.

Brazil Tractions fell a point to 63, although other things connected with Brazil are mostly good. Prices in the railway market are making rapid strides. British Columbia deferred is harder, and a satisfactory feature is the further recovery in Anglo-Argentine Tramways first preference shares, the price putting on another ½ to 3 11/16. The Argentine Republic has recovered very slowly from the effects imposed upon it by the war; and there can be no doubt that when it fairly turns the corner, prices will go ahead just as sharply as did those of companies trading in Brazil. The 4 per cent. debenture stock is better at 76; the 4½ per cent. has improved to 75¾, which is about a couple of points lower than the 5 per cent. debenture stock.

Bombay Electrics are good at 16½. The British Electric Traction issues are also firm, the 5 per cent. debenture stock changing hands the other day at 80½, and the 4½ per cent. second debenture stock at 70½. Calcutta Tramways ordinary have been done within the last few days at 6¼, which is £1 a share lower than they stood upon the outbreak of war.

The rubber share market is steady, notwithstanding a further decline in the price of the raw material to 2s. 5½d. per lb. Business is accordingly quiet, and interest has drifted away to a large extent into other and more active departments of the industrial section of the Stock Exchange. At the same time, the decline in rubber has not led to any particular selling. Copper shares have weakened, in consequence of the smart drop in the price of copper. Base metal shares of various kinds are under something of a cloud. Armament issues, on the other hand, tend to improve, in sympathy with the strength shown by iron and steel shares generally.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price June 22, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6¼	—	£7 13 10
Charing Cross Ordinary	5	5	8⅛	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	3¼	—	6 18 6
Chelsea	5	4	3	– ¼	6 13 4
City of London	9	8	12	—	6 13 4
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 3
County of London	7	7	10½	—	6 16 7
do. 6 per cent. Pref.	6	6	10⅝	—	5 15 8
Kensington Ordinary	9	7	5	—	7 0 0
London Electric	4	3	1 2/16	—	7 11 0
do. do. 6 per cent. Pref.	6	6	4¼	—	7 1 2
Metropolitan	3½	3	2⅜	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	3	—	7 10 0
St. James' and Pall Mall	10	8	5½	—	6 16 4
South London	5	5	2⅝	—	8 13 10
South Metropolitan Pref.	7	7	1 7/16	—	6 14 0
Westminster Ordinary	9	7	6	+ ⅜	5 16 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	104	+ 1	5 15 5
do. Def.	30/-	33/6	23	–	7 10 9
Chile Telephone	8	8	6⅜	—	6 5 6
Cuba Sub. Ord.	5	5	7½		6 13 4
Eastern Extension	7	8	14⅜	+ ⅛	*5 11 4
Eastern Tel. Ord.	7	8	146	+2	*5 9 7
Globe Tel. and T. Ord.	6	7	12⅜	—	*5 12 0
do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	22	22	37	—	5 19 0
Indo-European	13	13	49		5 12 8
Marconi	10	—	2 1/16	+ ½	3 1' 6
New York Tel. 4½	4½	4½	102½	—	4 7 10
Oriental Telephone Ord.	10	10	1 15/16	-	5 8 1
United R. Plate Tel.	8	8	6¾ xd	—	*6 5 6
West India and Pan.	1	Nil	2/9	-	9 6 1
Western Telegraph	7	8	15	+ ⅜	*5 6 8
Home Rails.					
Central London, Ord. Assented	4	4	72	+1	5 11 1
Metropolitan	1½	1	27½	+ ½	3 12 9
do. District	Nil	Nil	19⅛	— ¼	Nil
Underground Electric Ordinary	Nil	Nil	1 1/16	+ ⅛	Nil
do. do. "A"	Nil	Nil	6/-		Nil
do. do. Income	6	6	87	— ½	*6 18 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	8 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	3 11/16	+ ⅛	7 9 2
do. 2nd Pref.	5½	5½	3½	—	8 9 2
do. 5 Deb.	5	5	77½	—	6 8 7
Brazil Tractions	4	4	63	- 1	6 7 0
Bombay Electric Pref.	6	6	16⅜	—	5 15 8
British Columbia Elec. Rly. Pfce.	5	5	59	—	9 9 8
do. do. Preferred	—	Nil	40	—	Nil
do. do. Deferred	—	Nil	39	+1	Nil
do. do. Deb.	4½	4½	62	-	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	42	—	Nil
do. 6 per cent. Bonds	—	Nil	35	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	32	—	Nil
do. 1st Bonds	Nil	Nil	42	—	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	22	—	6 9 1
British Aluminium Ord.	5	7	28/6	-6d.	5 5 8
British Insulated Ord.	15	17½	10½	—	7 2 10
British Westinghouse Pref.	7½	7½	46/6	+6d.	6 9 0
Callenders	15	20	12½	—	8 0 0
do. 5 Pref.	5	5	4½	-	5 17 8
Castner-Kellner	20	—	1 5/16	+ 5/16	5 10 3
Edison & Swan, £3 paid	Nil	—	10/6	+6d.	Nil
do. do. fully paid	Nil	—	1½	—	Nil
do. do. 5 per cent. Deb.	5	5	57	—	8 15 8
Electric Construction	6	7½	14/6	—	10 6 10
Gen. Elec. Pref.	6	6	9⅜	—	6 4 8
Henley	20	25	15	—	8 6 8
do. ½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	11½	—	*8 13 10
Telegraph Con.	20	20	89	—	*6 4 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£54	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£30	..
a Copper Sulphate	,,	£53	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	9 /-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	,,	£ 4	..
a ,, Lump	,,	£10	..
a Soda, Chlorate	per lb.	1/4½	..
a ,, Crystals	per ton	12 /-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	1/4½ to 1/4¾	½d. dec.
c ,, Tubes (solid drawn)	,,	1/ ⅜ to 1/4¼	⅛d. to ½ dec
c ,, Wire, basis	,,	1/4½ to 1/5	¼d. to ⅜ dec.
c Copper Tubes (solid drawn)	,,	1/7 to 1/7½	⅜d. dec.
g ,, Bars (best selected)	per ton	£160	£4 dec.
g ,, Sheet	,,	£160	£4 dec.
g ,, Rod	,,	£160	£4 dec.
d ,, (Electrolytic) Bars	,,	£139	£1 dec.
d ,, ,, Sheets	,,	£157	£1 dec.
d ,, ,, Rods	,,	£146	£1 dec.
d ,, ,, H.C. Wire	per lb.	1/5½	¼d. dec.
f Ebonite Rod	,,	5/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6-10	..
h India-rubber, Para fine	,,	2/5	2d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£36	..
g Lead, English Pig	,,	£32	25s. dec.
g Mercury	per bot.	£16 12 6 to £16 15	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	,,	£178 to £179	£11–£12 dc.
n ,, Wire, Nos. 1 to 16	per lb.	3/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Aluminium Corporation, Ltd.—The report for 1915 shows continued improvement, and a further improvement in net profits, which, after providing for debenture interest and other charges, amount to £14,257, plus £3,286 brought forward. The directors recommend a dividend of 7 per cent., less tax, upon the preference stock, leaving to carry forward £4,559 to the next account, when the questions relating to depreciation will be dealt with. The driving of the Dulyn Tunnel was completed early in the present year, and has already fully justified its construction. Arrangements have been made to increase considerably the water power, and the consent of the Treasury has been obtained to the issue of another £100,000 of first mortgage debentures. It is therefore proposed to obtain the approval of the existing debenture holders to the creation and issue of this amount, increasing the total authorised issue to £250,000.

French Thomson-Houston Co.—The report of the Cie. Française pour l'Exploitation des Procedes Thomson-Houston for 1915 states that the net profits amounted to 4,821,778 francs, an increase of 272,000 francs. In order to strengthen the financial position, 40,000 6 per cent. bonds of 500 francs each were issued. A dividend of 7 per cent. is proposed, leaving 197,614 francs to be carried forward.—*Financial Times.*

Eastern Telegraph Co., Ltd.—Preference dividend at the rate of 3½ per cent. per annum, less income-tax, for the quarter ended June; also a first quarterly interim dividend of 1½ per cent. on the ordinary stock, free of tax.

Ruston, Proctor & Co., Ltd.—Final dividend on the ordinary shares making 8 per cent. for the year, plus a bonus of 2 per cent., both less income-tax. £45,000 has been placed to reserve and £16,300 carried forward.

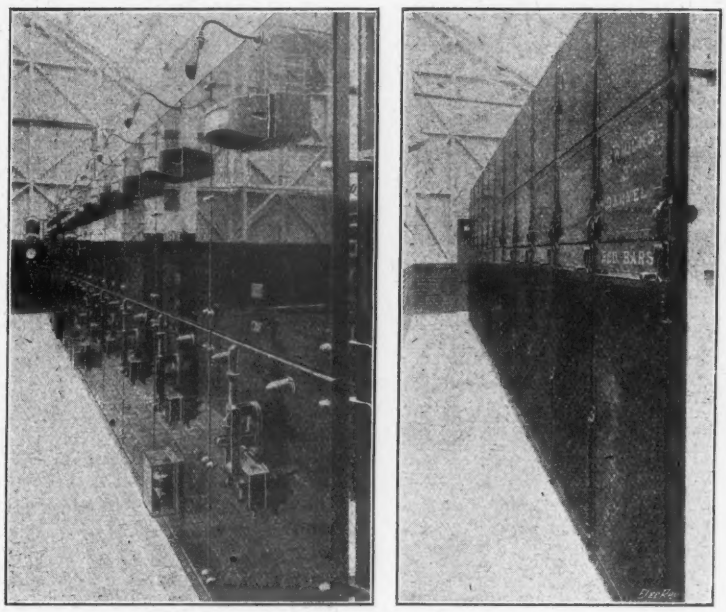
Anglo-Argentine Tramways Co., Ltd.—We understand that the directors have decided not to pay an interim dividend on the second preference shares.

Bullers, Ltd.—An interim dividend at the rate of 5 per cent. per annum (5s. per share), free of tax, is announced.

MUNICIPAL ELECTRICAL EXTENSIONS AT KILMARNOCK.

(*Concluded from page* 669.)

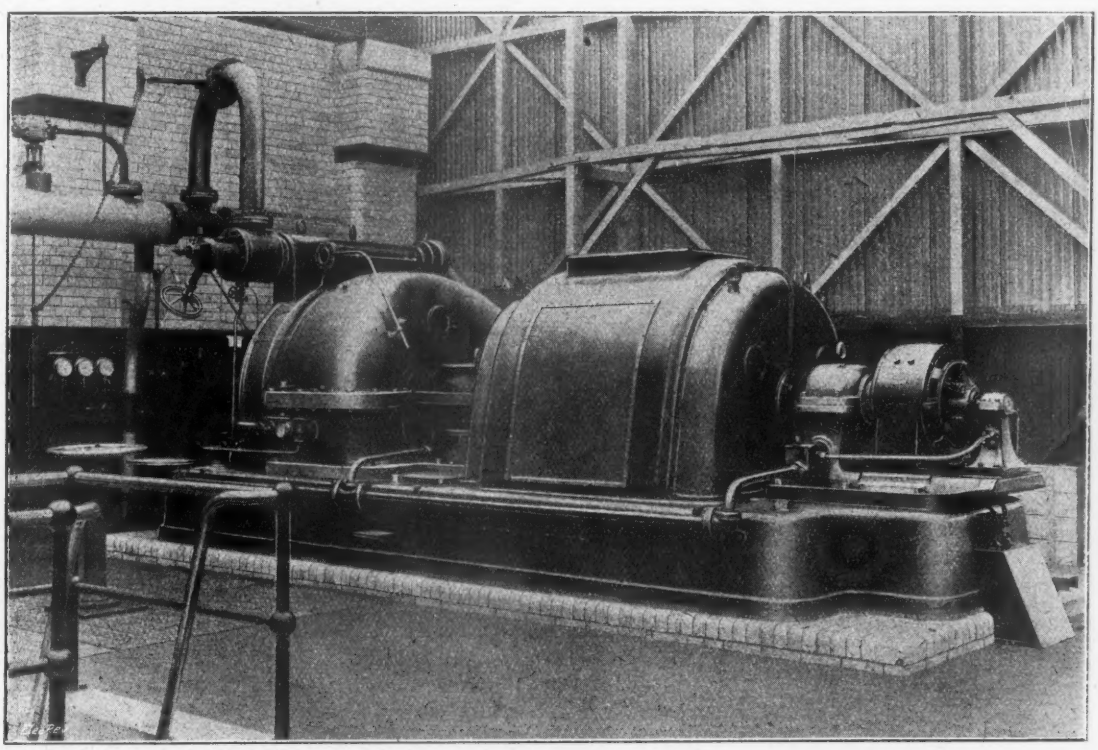
The transmission line to supply the eastern area was not completed until the end of the summer; thus this line is not so revenue-producing as the western route. However, a number of the mills are considering offers for completely electrifying their plants. This transmission line is similar in design and capacity to the western section. The sub-stations at Galston, Newmilns, and Darvel are erected in close proximity to the power line, and in each case the line loops in and out of these sub-stations, so that the circuit can be divided up. At a point between Kilmarnock and Galston a tapping is taken into the sub-station of Messrs. A. Strang & Co., Ltd., where a 50-K.V.A. transformer is installed, and arrangements are made whereby a supply can be given to the village of Hurlford.



High-pressure Switchgear, and Cubicles.

At Galston the sub-station is similar to those at Troon and Irvine, but the transformer ratio is 11,000/415 volts. Low-pressure mains are laid from this sub-station into the town. The supply here was available in the middle of January, 1916; the Wholesale Co-operative Blanket Works have some 150 H.P. installed, and a number of smaller consumers have been connected. Ducts are laid with the low-pressure mains for installing H.P. mains immediately the demand for energy warrants the extension. As mentioned, the transmission line is looped into this sub-station, and continues on to the Burgh of Newmilns. Between Galston and Newmilns the supply is teed off to the Loudoun Pit, and an 11,000/3,300-volt transformer is installed. Here one 100-H.P. and one 50-H.P. motors are running day and night, driving turbine pumps placed at the bottom of the pit shaft; the adoption of electric winding is also under consideration.

The sub-station at Newmilns is erected under a railway arch, and L.T. mains run to the various mills. New mills are in course of erection, and the manufacturers are driving throughout by electricity, utilising a motor on each loom. It is essential that the loom drive shall be steady and not jerky when starting up; with a modern spring adjustment on the motor, the starting-up trouble has been overcome, and the three-phase A.C. motor is recognised to be a complete success in every respect. There is no doubt, therefore, that many of the manufacturers, now that the electric drive on lace looms is proved to be satisfactory, will eventually discard their steam engines and adopt the electric drive.

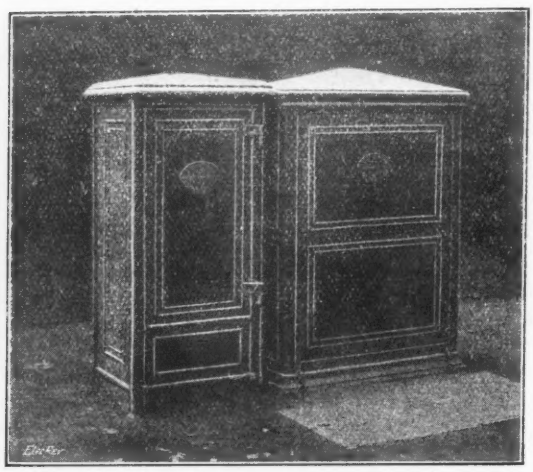


B.T.H. 2 500-kw. Turbo-Generator.

Owing to the mills not being in close proximity to one

another at Darvel, as is the case at Newmilns, 3,300-volt mains are laid in the burgh to the various mills. The sub-station is similar to those already described, the transformer ratio being 11,000/3,300 volts.

The supply at Darvel has only been available for a few weeks, and only one mill is as yet electrified, but applications from others have already been received. Messrs. Stirling & Auld, prior to taking the Corporation supply,

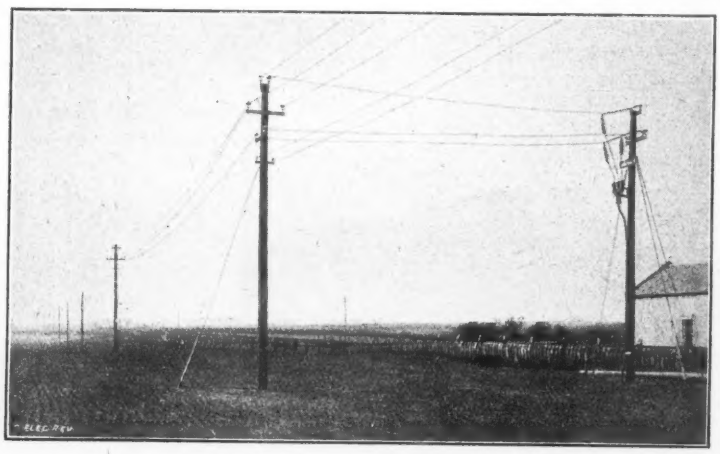


High-pressure Switch Pillar and Transformer Kiosk.

generated their own electricity by means of an 80-h.p. suction gas engine and belt-driven alternator.

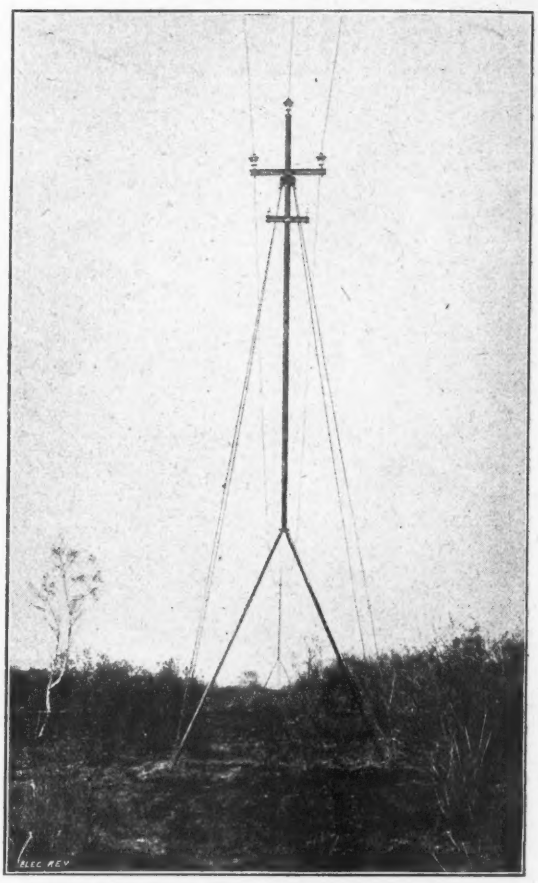
To cope with the demands from the Burgh of Kilmarnock, and its recently-extended area of supply, extensive alterations have taken place at the power station, and extensions to the engine room and boiler house, and a switch annexe, have been built. A turbo-alternator set of 1,500 kw. was installed in January, 1915, and a further similar 2,500-kw. set was put on load in April, 1916, bringing the total plant capacity to 5,550 kw., there being nine sets in all, three of which are turbo-alternators. Both the 1,500 and 2,500-kw. turbines are of the B.T.H. horizontal Curtis type, running at 3,000 r.p.m., and driving 3,300-volt, 50-cycle alternators, with the exciters on the ends of the shafts. The 1,500-kw. set is designed for 25 per cent. overload and 50 per cent. momentary overload, but the 2,500-kw. set is designed for 50 per cent. overload for a long period. On both alternators a Heenan & Froude air filter is provided.

The condenser on the 1,500-kw. set is of the surface type, with the air, circulation, and extraction pumps driven by an auxiliary turbine manufactured by Messrs. Mirrlees Watson.



Tee off E.H.P. Transmission Line to supply Irvine.

The condenser on the 2,500-kw. set is of the Worthington surface type, the air, circulating, and extraction pumps being driven by a B.T.H. steam turbine. The exhaust steam from the two auxiliary turbines can be passed into a direct-contact feed-water heater situated on the top of a hot-well tank, or put into the main turbine condenser. With the 2,500-kw. turbine a Lea recorder is installed.



Callender K Towers crossing Bog Land (see p. 668).

The high-pressure switchgear supplied by the British Thomson-Houston Co. consists of one Tirrill regulator panel, three machine panels, two converter panels, and six feeder panels. Immediately behind the control board and in the switch annexe are built concrete cubicles containing bus-bars, switches, &c. The whole of the bus-bars and isolating switches are duplicated, and the doors of the cubicles are interlocked with the switches.

In order to make full use of the efficient turbo-alternators, one 500-kw. and one 300-kw. Bruce Peebles motor-converters are installed in the power station to supply the direct current for lighting and tramways, and these also run in parallel with the converters at the Langland Street sub-station. These machines have the same voltage regulation as the d.c. generators, and can be run in parallel with them.

In the boiler house one 20,000-lb. Babcock & Wilcox boiler has been added, and a similar one is in course of erection at the works, making a total of eight boilers, three of which are of the Lancashire type. Owing to the cheap grade of fuel which can be had around Kilmarnock, this new boiler is fitted with "undergate" forced draught. This was the first of Messrs. Babcock and Wilcox's manufacture, and it has been found that a very small and cheap class of smudge can be burned economically and well. B.T.H. steam-flow meters are installed in connection with the chain-grate stokers. An induced-draught plant is at present being erected, and much better evaporation is expected from the boilers when

this plant is working. A railway siding runs direct over the coal-bunkers in front of the boilers, and the usual bunker elevators are in use for taking the coal into the stoker hoppers.

The pumping plant consists of three Weir double-acting feed pumps, and a rotary feed pump will be installed shortly. Although the works are situated on a bank of the river Irvine, a shortage of water was experienced during the summer, the river being dammed at a number of places. To overcome this difficulty, 36-in. ferro-concrete pipes have been laid from the nearest dam to the works, and an ample supply of water is now available. The condenser and pumps are now always flooded.

The maximum load during the winter of the year ending May 15th, 1915, was 1,340 KW., and the average day load for the last four months has been 2,000-2,200 KW. This load would have been some 500 KW. better had sufficient plant been available, but owing to the delay in getting the 2,500-KW. turbo-alternator into commission, it has been necessary to restrict a number of the large consumers from taking the whole of their requirements.

The majority of the large consumers are under agreements for 10 to 15 years, the Corporation covering itself against increased cost of coal by inserting a coal clause in these agreements.

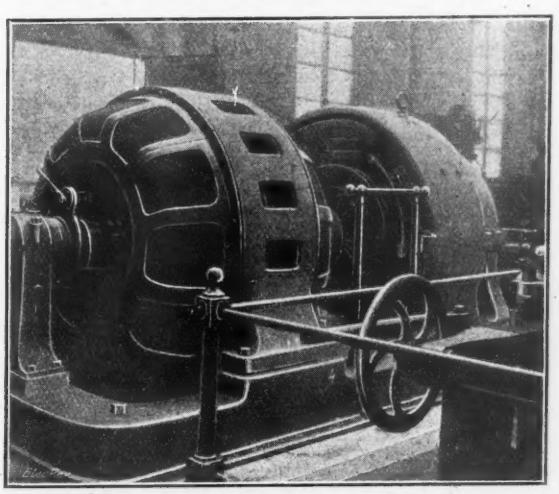
The transmission lines were erected by Messrs. Callender's Cable and Construction Co., Ltd.; the total length of overhead mains is 19·78 miles, and the total number of poles 581, spaced, as a rule, 55 to 60 yards apart.

The A.C. supply-pressure is kept constant by means of a Tirrill regulator; the alternators are star-wound, and the neutral point is connected to earth through a limiting resistance.

The Town Council of Kilmarnock is doing everything possible to further the interests of the electricity department, and a showroom has recently been opened. The tariff charges for lighting and power are reasonably low in Kilmarnock, and even in the outer areas the lighting is at the same rate, but the power charges are 10 per cent. above the Kilmarnock rates. However, at this figure the power consumers are finding the electric drive more economical than their old steam or gas engines.

The construction of the outside extension was not commenced until June, 1914, and was greatly delayed owing to the difficulty in getting material consequent on the war, but practically the whole scheme will be completed in three months' time, except for local extensions. Up to May 15th, 1916, some 2,050 H.P. in motors had been connected.

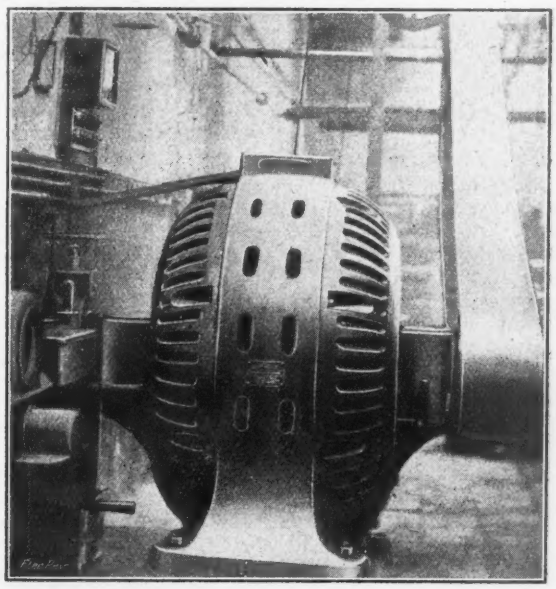
The 11,000-volt transformers were supplied by Messrs. Ferranti, Ltd., and are of the oil-cooled type; the end



Peebles 500-KW. Motor Converter at Glenfield and Kennedy's Works.

turns are specially insulated to withstand increased pressure, and each transformer has approximately 5 per cent. reactance. A number of the transformers have their coils clamped by means of the above makers' patented spring clamp, and all the transformers have their coils clamped in order to withstand, as far as possible, short circuits and overloads. Tappings of 11,000, 10,800, 10,600, 10,400, 10,200, and 10,000 volts are taken out of the transformers, in order that the correct voltage may be obtained. The kiosk transformers are air-cooled, and are of the well-known "Berry" make.

The underground cables were supplied by Messrs. Callender's Cable and Construction Co., Ltd., and were laid by the Kilmarnock Corporation Electricity Department.



Siemens 100-H.P. Motor Drive at Spinning Mill.

In conclusion, we must express our indebtedness to Mr. William Bexon, the burgh electrical engineer, for providing us with particulars and views of the extensive supply scheme under his control, towards the success of which his efforts have so greatly contributed.

GERMAN SUBSTITUTES AND ECONOMIES IN ELECTRICAL CONDUCTORS.

The oft-repeated boast that Germany has within her own borders many years' supply of copper, and has secured inexhaustible supplies in allied or occupied territory in the Near East, has been accompanied by an ever more extensive commandeering of domestic copperware, and, in the electrical field, by the most vigorous efforts to find a substitute for copper conductors. At first iron wire and cables were employed, but these soon proved very inconvenient, apart from the fact that the conductivity of iron is only about one-eighth that of copper. Aluminium is, of course, quite a useful substitute for copper in practically every electrical application, and the fact that the enemy has gone the length of formulating rules concerning the use of zinc and iron in wiring and in machine windings merely indicates that the shortage of aluminium is as serious as that of copper. The conductivity of zinc is more than twice as great as that of iron, and the metal is non-magnetic, and more flexible and convenient in its mechanical properties. In this respect the latest zinc wiring on the German market is claimed to be almost equal to copper. Under favourable circumstances, this is probably the case, but it is never possible to rely on a single zinc conductor being sound throughout its length, and the mechanical properties of zinc are inferior and treacherous at temperatures much above or below normal atmospheric temperature. Zinc cables may not be laid during frost, and, once laid, they must not be moved except with very great care, and only between narrow limits of temperature. Electrolytic corrosion, at the expense of the zinc, is very apt to occur at all junctions with dissimilar metals, and mechanical contact clamps are preferable to soldered joints, owing to the low

melting point of zinc and the risk of coarsening the crystalline structure and rendering the metal brittle by heat. For this reason, zinc wiring or windings may not be used in hot situations, and joint-boxes must be as small as possible, and filled with a compound melting at somewhere below the boiling point of water. Zinc may not be used for overhead lines, and zinc windings are not safe in motors to be used out of doors, neither are they safe in totally-enclosed machines; indeed, they are not reliable enough under any circumstances to be considered safe for use in electrical apparatus for military service. As an approximate rule, zinc conductors may be worked at half the current density, giving the same temperature rise as in copper conductors.

Only a few weeks ago fresh rules were published by the V.D.E. concerning the use of aluminium and zinc lighting wires, pendant and workshop flexibles, as well as rubber-insulated and armoured aluminium cables. A further economy, prescribed "for the duration of the war and a suitable time thereafter," relates to the thickness of lead on lead-sheathed cables. This is to be reduced to values indicated by the following summary, in which the approximate equivalents of the I.E.E. values are added for comparison. Double-lead sheathing is prohibited for the present.

Effective copper section.	Thickness of lead sheathing. New V.D.E. Rules.	I.E.E. Rules (approx.).
1 to 10 sq. mm.	1·0 mm.	1·5 mm.
35 to 50 ,,	1·2 ,,	1·8 ,,
95 ,,	1·3 ,,	2·0 ,,
150 ,,	1·5 ,,	2·3 ,,
240 ,,	1·7 ,,	2·5 ,,
500 ,,	2·0 ,,	3·0 ,,
1,000 ,,	2·5 ,,	—

Concentric and multicore cables may have a single lead sheathing, the thickness specified advancing by steps of 0·1 mm. from 1·1 mm. for cables 10 mm. or less in diameter (under the sheathing) up to 3 mm. for cables 70 mm. in diameter.

By agreement with the Association of Central Stations and with cable manufacturers, it is arranged that all conductors insulated with "regenerated rubber" shall have a bright green identification thread.

The war-time fittings wire, for use only in or on low-pressure lighting fittings, consists of a solid aluminium or a 7-strand aluminium or zinc wire of 0·75 sq. mm. cross-section, covered with 0·8 mm. of vulcanised rubber, which may be "regenerated" material. Over this there is the usual impregnated cotton or silk braiding, and the test for the finished material is ability to withstand 1,000 V., A.C., for half an hour between the cores of 5 metres of twin conductor or between two single wires twisted together.

Pendant wires are insulated similarly, and subjected to the same electrical test, but the conductor section is increased to 1 sq. mm., and consists of 19 aluminium or zinc strands. One, or, if preferred, two tension flexibles are stranded with the current-carrying cores, and the whole, after braiding, must be flexible enough to pass without injury over a 25-mm. roller in the case of single cords, and over a 35-mm. roller in the case of double cords.

Flexible for domestic service, subjected to small mechanical stress and lower pressure, is to consist of aluminium or zinc wires of at most 0·3 mm. diameter, suitably twisted together. The smallest permissible section is 1 sq. mm. in aluminium and 1·5 sq. mm. in zinc; the largest permissible sections are 2·5 mm. and 4 sq. mm. respectively. Each core must have at least 1 mm. (radial) of rubber sheathing (which may be "regenerated"), and over that a braiding. The test for this class of wiring is ability to withstand 2,000 volts A.C. for half-an-hour on 5-metre test lengths after immersion in water for 24 hours. Workshop flex is of similar construction, but sections up to 16 sq. mm. are permissible, and wires 0·4 mm. in diameter may be used in sections exceeding 6 sq. mm. Vulcanised rubber insulation is specified, and this must be covered with impregnated tape or paper. Two or more cores are placed together under a strong outer braiding; earthing conductors must have strands not exceeding 0·3 mm. diameter.

The following extract from the wiring table for aluminium and zinc wires may be compared with the I.E.E. limits for copper:—

Conductor section.	Maximum permissible current. Aluminium (V.D.E.)	Zinc (V.D.E.)	Copper (I.E.E. approx.)
1 sq. mm.	8 amps.	—	6 amps.
4 ,, ,,	20 ,,	13 amps.	24 ,,
10 ,, ,,	34 ,,	23 ,,	38-57* ,,
25 ,, ,,	80 ,,	52 ,,	64-103 ,,
50 ,, ,,	125 ,,	83 ,,	98-158 ,,
95 ,, ,,	190 ,,	125 ,,	150-245 ,,
150 ,, ,,	255 ,,	170 ,,	204-327 ,,

* Rubber and paper insulation respectively.

In addition to last year's rules sanctioning rubber-insulated zinc cables for use in low-pressure permanent installations, rules have been issued for rubber-insulated aluminium wires of the same general construction, but permitted in sections down to 1 sq. mm., this conductor having 7 strands and at least 1 mm. thickness of rubber. In armoured aluminium cables the minimum conductor section is 1 sq. mm. The following figures show the maximum permissible sustained current flow in a few sizes of aluminium cables laid in earth, and give a good idea of the rating permitted:—

Aluminium conductor section, sq. mm.	Single-core cables to 750 V.	Maximum sustained current, cables laid in earth. 3,000-volt cables: 2-core.	3-core.	4-core.	Concentric	Triple con.	10,000-volt cables: 2-core.	3-core.	4-core.
4	42	32	28	26	—	—	—	—	—
10	75	55	50	44	55	42	50	46	42
50	200	145	125	115	140	115	135	120	105
150	390	275	240	220	275	220	255	230	210
240	515	360	320	295	360	295	—	—	—
400	695	485	435	—	490	405	—	—	—
1,000	1,200	—	—	—	—	—	—	—	—

The specific resistance of the aluminium and zinc conductors covered by the above tables may not exceed 0·030 ohm and 0·0067 ohm respectively, per sq. mm. per metre at 20° C.

Bus-bars and other interconnectors can be made of zinc without difficulty, except that precautions must be taken against corrosion at contacts where iron screws are necessarily employed. Rules have been framed also for the use of zinc wires and iron slip-rings in electrical machinery and transformers, but in these applications the defects of the substitutes are very pronounced. Zinc windings with anything like reasonable losses cannot be easily accommodated, particularly on rotors, and iron is one of the worst metals from the sparking point of view. From the provisions of the V.D.E. rules it appears that zinc windings are scarcely practicable in machines or transformers exceeding 250 KW., and that serious difficulties are often encountered in apparatus of 50 to 100 KW. In all cases the first cost of the zinc-wound apparatus seems to be at least as high as that of standard construction, and the cost of running losses is, of course, much greater. There is no reason to believe that zinc conductors will ever be used otherwise than under the compulsion of necessity.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Bennis Automatic Elevators.

An automatic mechanism has recently been added to the design of the Bennis independent elevators. The Bennis bucket elevator consists of a strong steel chain to which buckets are attached at regular intervals; the coal is fed into the elevator boot by means of the Bennis rotary safety feeder at a suitable speed, rendering choking of the bucket by over-supply impossible. The shoot which feeds the fuel from the elevator head to the hopper is swung on a balanced lever supported by the elevator head; the tail end of the shoot is supported by means of a chain, rod, or wire rope. The elevator feeds the coal into a small hopper forming the upper end of the shoot. When the shoot is empty, the weight on the balance lever draws the belt on to the driving pulley through a parallel link motion, so that the elevator starts up. When the shoot fills, it overbalances the balance lever and pushes the strap fork on to the loose pulley, and the elevator is brought to a stop.

When the shoots are about half empty, the balance lever comes into operation again, and the elevator starts up. By this means there is always a sufficient supply of coal to keep the hoppers full, but the elevator is never allowed to overflow. The rate of revolu-

tion of the rotary feed can be altered by the raising or lowering of a handle. The device, views of which are given in figs. 1 and 2, can be applied to any existing elevator, and diminishes the cost of attendance, an important matter in these times.

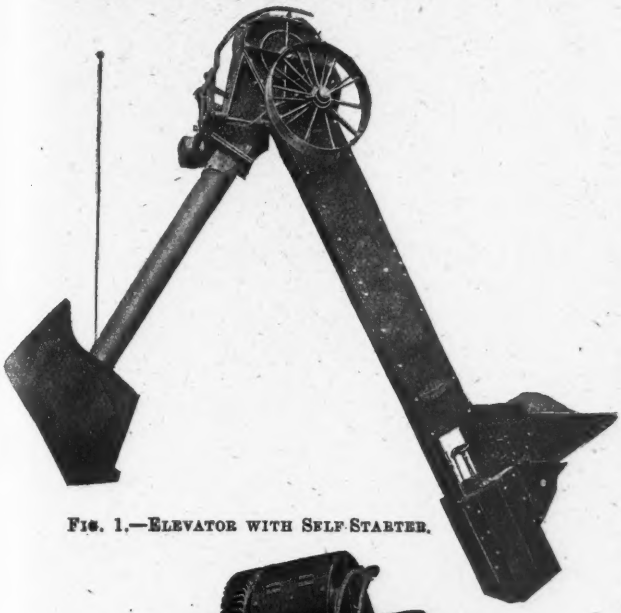


Fig. 1.—Elevator with Self-Starter.

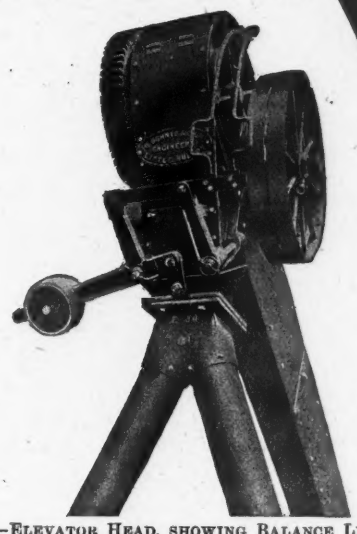


Fig. 2.—Elevator Head, showing Balance Lever and Belt Fork.

The apparatus is manufactured by Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, and 28, Victoria Street, S.W.

Isolating Switches.

A line of substantial isolating switches for use on high-pressure systems has been designed by the British Thomson-Houston Co., Ltd., of Rugby, for pressures up to 11,000 volts, and currents to 1,200 amperes. The switches are made in several patterns, of which Type I is illustrated in fig. 3. The switches are, with few

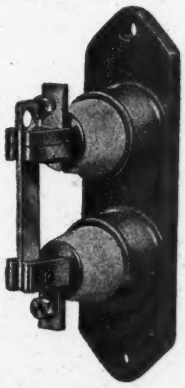


Fig. 3.—200-amp. Isolating Switch on Cast-iron Base.

exceptions, of wrought copper, carried on white porcelain insulators, and are designed to be operated by means of insulated hooks on wooden handles. Interlocking mechanism and safety catches can be provided if required. For three-phase circuits rotary switches are made.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

"O Ye of Little Faith."

Why is it that the electrical men of this country have such little faith in advertising and modern methods of selling? The seventh instalment of your contributor's article on the "Selling Side of Electricity Supply," has evoked this outburst from an otherwise peaceful citizen. One would think that the product, and the accessories to that product, which we are so interested in, are unworthy of expenditure in the matter of advertising and sales promotion.

Your contributor shows a lack of knowledge of true advertising by stating that artistic *embellishment* is necessary to the success of a piece of advertising matter! A calendar or diary is not the best form of advertising, neither is it the first form of advertising to adopt! What is the matter with a piece of blotting paper printed on one side? It is cheaper than the calendar, and is needed in most households; but how poor must be the claims of the product if, in order to secure attention, we must give away something that is "useful."

To suggest that any form of advertising should be prohibitive on account of expense, is at once to label it as unsound in principle, and therefore not in any sense good business.

Again, what value does he place upon the claims of electrical domestic appliances, when he says that the meter-reader should not *waste* his time canvassing. Why talk of increasing sales by giving the meter-reader an increase in wages of 6d. per week?

Do not the merits of the electric iron, toaster or vacuum cleaner warrant the adoption of ordinary commercial methods; and is it impossible for a good traveller, receiving a salary of about £5 a week and commission, to earn this sum by selling electricity and domestic appliances? If such is the case, why discuss the question?

In a recent advertisement a manufacturer was appealing to central-station engineers and contractors to acquaint themselves with electric cooking and heating by using the appliances themselves. Can we hope to increase the demand for articles which do not merit a place in our own homes?

Until we have confidence in our wares, and look upon advertising (by which I mean the employment of men as well as printed matter) as an investment instead of an expense, we can only grow in spite of ourselves and through the sheer merits of our products.

I believe I am one of the few who have little faith in the co-operative idea of advertising—except as an adjunct of individual effort. The business of the world has been built by sane competition, and so long as we adopt methods which tend to stifle this, progress will be slow.

Advertising to be successful need not involve a vast expenditure, but it should be suited to local conditions and give the fullest possible information to prospective clients.

Co-operative literature cannot be made direct enough in its appeal to ensure an adequate return—it is necessarily too general.

Let each central-station engineer, contractor, and manufacturer who believes in advertising secure the assistance of a capable advertising man, and collaborate with him in spending the appropriation in the most direct way possible. If he feels inclined to put 10 per cent. of this money into a pool for a broader campaign, then he will be doing the right thing; his motto should be 90 per cent. direct, 10 per cent. indirect, until such time as he feels that the whole of the money can be best spent in his own way and in his own locality.

After 14 years' experience in advertising and selling in the electrical industry, I have found the fac-simile typewritten letter (with name and address filled in so well as to render it equal in all respects to an individual type-written original) to be one of the most productive forms of advertising. Added to this, should be an occasional business-like leaflet, which relies on photographic illustrations and the interest of its message rather than "artistic embellishment" to secure a reading.

Both will eventually find a resting-place in the waste-paper basket, but what matters if an adequate percentage has actually created a sale? We can afford to send these inexpensive forms of advertisements out again and again to those who have not purchased, and then secure the advantages of cumulative effect.

The central-station engineer is in a most favourable position in that he has a complete list of consumers, and by using the post he can eliminate all waste in advertising.

In the case of the London companies, conditions may be so different as to render it more profitable to take a London newspaper, in order to reach their consumers at a minimum expense. At least one supplier of domestic electrical appliances has found the London daily Press a paying medium, but then he is interested in all districts.

All these considerations are simple of solution when one has facts and figures to work upon; and the more one thinks of advertising in connection with electricity generally, the more one realises the vast possibilities in the field.

During the last few years manufacturers have shown a greater appreciation of the claims of the trade paper in the matter of advertising. It is a hopeful sign, and I doubt not but that other sections of the industry will fall into line eventually.

A. J. G.

Salaries for Engineers.

At this period one hardly likes to criticise an important Government department, which we all believe is doing good work, but a word of protest seems not out of place against the suggestion contained in an advertisement—in your issue of June 10th—of the Admiralty, that a fair salary for the services of a M.I.E.E. is £250 per annum.

I understand that men competent to supervise power and lighting plants are required, and for such it is only right that an adequate salary should be offered—especially as the appointments are not permanent. If the salary named is a fair return for the services required, then there can be no need for engineers who are sufficiently qualified to be full members of the Institution. The successful candidates will, I believe, be ranked as second assistants—not a particularly high degree. As it stands, the advertisement is distinctly open to the interpretation that the electrical department of the Admiralty has not much respect for the Institution and its standards of professional competency.

A.M.I.E.E.

60-cycle Transformers on 25-cycle Systems.

Could any reader explain why some transformers, designed to operate on a supply having a frequency of 60 cycles, work satisfactorily on a 25-cycle system, disregarding regulation and temperature, whilst others, although of the same type and output, cannot be used?

We are running certain transformers under this condition, and have several others that we cannot use.

Is there any way whereby these transformers could be used up, to save having them re-designed?

William Lovell.

London, N., *June 15th*, 1916.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

COLOMBIA.—A Resolution, dated December 29th, 1915, of the Minister of Hacienda notifies that goods dispatched to Colombia must be declared in the Consular invoices in the terms of the nomenclature of the Colombian Customs Tariff. Firms exporting goods to Colombia should therefore obtain from the importers or their agents the information necessary to enable them to do this.

VENEZUELA.—According to a recent Presidential Decree, electric batteries when imported into Venezuela must be declared in the Consular invoice as "pilas electricas," and will be dutiable under Class III of the Tariff at the rate (including surtaxes) of 0.391 bolivar per kilog. gross. (Bolivar = 9.6d.; kilog. = 2.2046 lb.)

Note.—It is important to preserve the exact (Spanish) wording mentioned above in the declaration for Consular invoice.

CHILE.—In virtue of a Law, dated February 29th, the fees to be charged from April 1st to December 31st next by Chilean Consular Officers are to be levied at the rates hitherto in force (viz., those fixed by the Law of September 21st, 1909), with an increase of 50 per cent. Particulars of the fees chargeable under the Law of 1909 are obtainable from the Commercial Intelligence Branch of the Board of Trade.

NEWFOUNDLAND.—The free entry of material for installing wireless telegraphy on board ships engaged in the trade and fisheries of Newfoundland was among the proposals made by the Minister of Finance and Customs in his Budget speech of April 18th. The Act embodying this proposal was passed on May 4th.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

7,934. "Electrical transmission and control of motion." L. G. W. GUEST and H. O. MERRIMAN. June 5th.

7,936. "Portable electric battery." A. SANDRINI. June 5th. (Italy, June 5th, 1915.)

7,942. "Systems of ship propulsion." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). June 5th.

7,963. "Electric switches." F. J. DECKER. June 5th.

7,995. "Telegraphy." E. S. HEURTLEY. June 6th.

8,003. "Underground circuit making and breaking device." E. BRODSKY. June 6th.

8,011. "Wireless signalling systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). June 6th.

8,042. "Ear protector for telephone and wireless telegraphy head receivers." I. J. TRIM. June 7th.

8,056. "Electrical water heaters." J. F. BARR. June 7th.

8,091. "Combined electric iron and heating apparatus." J. KLUIJTMANS. June 8th.

8,103. "Field telephones." E. THOMPSON. June 8th.

8,111. "Electrolytic apparatus." SIEMENS & HALSKE AKT. GES. June 8th. (Germany, June 24th, 1915.)

8,128. "Electric motor control systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). June 8th.

8,150. "Continuous-current dynamos." F. KESSELRING. June 8th.

8,165. "Systems of ship propulsion." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). June 9th.

8,166. "Electric traction devices." SOC. ANON. DITE ATELIERS DE CONSTRUCTIONS ELECTRIQUES DU NORD ET DE L'EST. June 9th. (France, December 31st, 1915.)

8,178. "Telephony." H. J. HERINK & RELAY AUTOMATIC TELEPHONE Co. June 9th.

8,179. "Telephone systems." H. J. HERINK & RELAY AUTOMATIC TELEPHONE Co. June 9th.

8,191. "Electromagnetic switches or contact makers." IGRANIC ELECTRIC Co. (Cutler-Hammer Manufacturing Co., U.S.A.). June 9th.

8,199. "Electric trucks." F. J. DECKER. June 9th. (U.S.A., June 9th, 1915.)

8,211. "Printing telegraph systems." A. D. CHARDWELL. June 9th.

8,216. "Sparking plugs for internal-combustion engines." F. A. L. JOHNSON. June 10th.

8,232. "Electric generators for road vehicles." A. F. EVANS. June 10th.

8,238. "Manufacture of galvanic batteries." J. J. LINZELL. June 10th.

8,239. "Manufacture of galvanic batteries." J. J. LINZELL. June 10th.

8,240. "Device for passing through the human body currents derived from ordinary town main electrical supply." E. E. GREVILLE. June 10th.

8,245. "Electric ignition or sparking arrangements." H. W. F. IRELAND AND SIEMENS BROS. & Co. June 10th.

PUBLISHED SPECIFICATIONS.

1914.

22,807. WIRELESS CONTROL SYSTEMS. M. Compare. November 20th.

23,505. TRANSFORMER CONNECTION FOR THREE-PHASE METAL VAPOUR RECTIFIERS. Allgemeine Elektricitäts Ges. December 3rd. (December 3rd, 1913.)

1915.

717. PROTECTION OF ELECTRIC CABLES. J. H. Bowden & H. F. J. Thompson. January 16th. (July 16th, 1915.)

2,897. ELECTRIC RAILWAY SYSTEMS. F. G. Brettell (C. W. Leffler, U.S.A.). February 23rd.

4,378. TELEGRAPHIC PRINTING APPARATUS. M. B. Rodriguez. March 20th.

7,467. ELECTRIC CURRENT LIMITING DEVICES. W. Hamilton, G. Wall and Ferranti, Ltd. May 18th.

7,546. ELECTRIC ACCUMULATORS OR STORAGE BATTERIES FOR USE IN ELECTRIC BATTERY LAMPS. S. D. Smith. May 19th.

7,579. TELEGRAPHY. E. S. Heurtley. May 20th.

7,829. PROCESS FOR MANUFACTURING METALLIC FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS AND FOR OTHER PURPOSES. K. Nishimoto. May 26th.

8,485. CENTRIFUGAL COMPRESSORS. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 8th.

9,582. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. and P. T. Bates. June 30th.

12,434. LOADED TELEPHONE LINE SYSTEM. Western Electric Co. August 30th.

13,769. LOADING COILS FOR TELEPHONE LINES. Western Electric Co. (Western Electric Co., U.S.A.) September 28th. (Addition to 12,434/15.)

13,869. ELECTRIC CURRENT DURATION METERS. A. Aubert. September 29th. (October 1st, 1914.)

15,128. ELECTRIC MEASURING INSTRUMENTS OF THE THERMAL TYPE. P. M. Lincoln. October 26th. (November 12th, 1914.)

15,792. ELECTRIC MOTORS. F. J. Osius. November 9th.

16,044. ELECTRIC KILLING APPARATUS FOR FLIES OR OTHER INSECTS. J. Satinover. November 13th. (November 27th, 1914.)

16,393. LOADED TELEPHONE LINE SYSTEM. Western Electric Co. (Western Electric Co., U.S.A.). November 20th. (Addition to 12,434/15.)

16,479. LOADED TELEPHONE LINE SYSTEM. Western Electric Co. (Western Electric Co., U.S.A.). November 22nd. (Addition to 12,434/15.)

17,322. MAKE-AND-BREAK DEVICES FOR MAGNETO ELECTRIC MACHINES USED IN CONJUNCTION WITH INTERNAL-COMBUSTION ENGINES. F. Stone & C. Hornby. December 10th.

17,974. ELECTRIC COUPLERS FOR ORGANS. H. Willis, Jun., & A. S. Cooke. December 23rd.

1916.

1,247. RESISTANCE UNITS AND THE MANUFACTURE THEREOF. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). January 26th, 1916. Patent No. 100,417.

1,876. MACHINE SWITCHING TELEPHONE SYSTEMS. Western Electric Co. (Western Electric Co., U.S.A.). February 8th. Patent No. 100,459.

2,742. SUBMARINE BOATS. Electric Boat Co. April 23rd, 1915. Patent No. 100,346.

4,022. MEANS FOR DRIVING DYNAMOS FROM ENGINES RUNNING AT VARIABLE SPEEDS. W. J. Mellersh-Jackson (A. Churchward). March 17th, Patent No. 100,428.

LIST OF BRITISH PATENTS EXPIRING DURING 1916.

361. January 6th, 1902. W. M. Brown. Electric railways, &c.

999. January 14th, 1902. E. de Pass. Railway points.

1,061. January 14th, 1902. F. G. Creed & W. A. Coulson. Electric telegraphs.

2,736. February 3rd, 1902. Gas engines. G. Honold.

3,227. February 8th, 1902. T. F. Walker & T. S. Walker. Logs.

3,737. February 13th, 1902. R. A. Hadfield. Alloys.

4,754. February 25th, 1902. R. Lundell. Dynamo-electric machines.

5,104.* February 28th, 1902. Soc. G. et P. de Mestral. Electric lamps.

5,530. March 5th, 1902. C. H. Merz. Measuring electricity.

5,812. March 8th, 1902. J. H. Woolliscroft. Electric switches.

6,666.* March 18th, 1902. J. H. St. H. Mawdsley. Dynamo-electric machines.

6,733. March 19th, 1902. W. D. Kilroy. Electric heating, &c.

6,884. March 20th, 1902. A. Graham. Telephonic apparatus.

7,689. April 1st, 1902. J. B. Struble. Railway signals.

7,995. April 5th, 1902. P. Jensen. Electrolysis.

8,558. April 12th, 1902. British Thomson-Houston Co. Controlling electric motors.

(To be continued.)